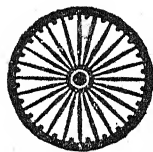


THE BASIC TEACHINGS OF THE Great Psychologists

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Preface

This book introduces the reader to the whole field of Psychology by describing the work of the psychologists who have made the most important contributions to the development of this absorbing science. Written primarily for men and women who have not taken courses in psychology yet who are interested in the subject, it also may appeal to former students who wish a "refresher" to bring themselves up to date.

Each chapter is devoted to an important aspect of the study of human behavior, such as intelligence testing, personality development, mental disease, motivation, emotions, thinking, imagination, social behavior, and psychology in everyday life. Included also are more specific topics, like measuring mechanical, artistic, and other aptitudes; studies of feeble-mindedness, genius, jungle children, and twins reared apart; standards of child development at various ages; brain, nervous system, and glands in human behavior; tests of personality; psychoanalysis with its study of the unconscious; theories of dreams; methods of learning and remembering; business, industrial, and personnel psychology. The material in each chapter is arranged approximately in chronological order, from the early discoveries to the most recent research.

Among the leading psychologists whose work is broad in scope and whose names appear prominently throughout the book are Binet, Freud, Galton, Helmholtz, Hollingworth, James, Thorndike, Watson, and Woodworth. Others, associated primarily with more specialized work, include Adler, Cannon, Cattell, Ebbinghaus, Gesell, Goddard, Janet, Jung, Koffka, Köhler, Kraepelin, Lashley, Lewin, Pavlov, Rorschach, Terman, Titchener, and Yerkes. The viewpoints of the various schools of psychological thought are outlined and contrasted. The work of psychiatrists, biologists, sociologists, and anthropologists who have markedly influenced psychology is mentioned in the relevant sections.

The index at the end of the book makes possible ready reference to the various contributions of each psychologist; it also includes many items not named in chapter headings—for instance, brain waves, temperament, fatigue, delinquency, inferiority feelings, paranoia, relaxation. A biographical appendix gives brief sketches of some 250 men and women whose work is dealt with in the book.

To several publishers I am grateful for permission to quote brief passages from psychologists' writings, as follows: D. APPLETON-CENTURY CO., INC., from *Psychology of Thought* by H. L. Hollingworth, and *Animal Intelligence* by G. J. Romanes; HARCOURT, BRACE AND COMPANY, INC., from *Middletown* by Robert S. and Helen Merrell Lynd; HENRY HOLT AND COMPANY, INC., from *Principles of Psychology* by William James, and *Intelligence Testing* by Rudolf Pintner; HOUGHTON MIFFLIN COMPANY, from *Psychology of Adjustment* by L. F. Shaffer; ALFRED A. KNOPF, INC., from *The Human Mind* by Karl A. Menninger; J. B. LIPPINCOTT COMPANY, from *Brightness and Dullness in Children* by Herbert Woodrow; LIVERIGHT PUBLISHING CORPORATION, from *A General Introduction to Psychoanalysis* by Sigmund Freud; MCGRAW-HILL BOOK COMPANY, INC., for permission to redraw an illustration from *Infant Behavior* by Gesell and Thompson; WILLIAM MORROW & COMPANY, INC., from *Sex and Temperament* by Margaret Mead, Copyright 1935 by Margaret Mead; W. W. NORTON & COMPANY, INC., from *Behaviorism* by J. B. Watson.

I am indebted to many psychologists whose lectures, researches, and writings have contributed to my knowledge of and interest in psychology. I wish to express gratitude to my two colleagues, Dr. Tom Gaylord Andrews and Dr. Gelolo McHugh, who read and criticised portions of the manuscript, and to my wife, Virginia Maxson Sargent, whose careful and constructive editing helped to make the book more readable.

S. STANSFELD SARGENT

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CHAPTER I

The Science of Psychology

WEBER FECHNER HELMHOLTZ HERING
PEARSON WUNDT TITCHENER HÖFFDING
JAMES DEWEY ANGELL WATSON
FREUD KÖHLER KOFFKA



What is psychology? How did the science of psychology develop? What methods do psychologists use in their research? How is psychology related to other sciences? What are the important fields or subdivisions of psychology? What is meant by "schools" of psychology?

PSYCHOLOGY is the science of human behavior. It aims to understand human behavior, to predict human behavior, and when necessary to change human behavior.

How Psychology Developed

Until the late nineteenth century psychology was not considered a science. Its subject matter fell in the realm of philosophy, like most other knowledge in ancient and medieval times. Many great philosophers, including Plato and Aristotle, speculated about human nature and proposed theories, some of which lasted until modern times. But careful and systematic observation of human behavior, let alone experimentation, was unknown.

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In the sixteenth and seventeenth centuries astronomy, physics, and chemistry broke away from philosophy to become separate sciences. Biology, less exact because it dealt with living things, became independent in the eighteenth century. Psychology hung on to its parent philosophy until nearly the end of the next century.

With the pioneer work of German physiologists like ERNST HEINRICH WEBER, GUSTAV THEODOR FECHNER, HERMANN VON HELMHOLTZ, and EWALD HERING, it became apparent that human behavior is closely related to bodily functions. It was hard to know where physiologists left off and psychologists began. This was true of studies of the eye, ear, and other sense organs, of the nervous system, or reflexes and muscular reactions. Gradually it became clear that the physiologist studies the functions of organs *within* the organism—respiration, circulation, digestion, and so on—while the psychologist studies the functioning of the *whole organism* as it responds to outside stimuli.

In the 1880's and 1890's a new group of psychologists, trained in both philosophy and physiology, founded laboratories in Germany and America, and psychology began its career as an experimental science.

Soon the close tie between psychology and newly emerging social sciences—particularly sociology, anthropology, and political science—became apparent, since man's behavior is largely social. Now we locate psychology between biology and the social sciences. An "in-between" field, physiological psychology, joins psychology with biology on the one side, while another such field, social psychology, connects it with the social sciences on the other.

The Fields of Psychology

The study of human behavior includes a broad area. Research on eye, ear, or brain functions relates closely to physiology and neurology. Studies of attitudes, opinions, and propaganda are

akin to sociology and other social sciences. Between these extremes the majority of psychologists work away at understanding the abilities, emotions, motives, memories, and whole personalities of children, adolescents, and adults, both normal and abnormal. Because psychology includes such varied material, several specialized subdivisions have developed.

In some of these fields emphasis falls on facts, principles, and theories rather than on applications. Fields that stress the solving of practical problems are included in "applied psychology." Actually no sharp distinction can be made between "pure" and "applied" psychology. All theoretical discoveries have possibilities for future usefulness. The most practical branches, like industrial and clinical psychology, owe a debt to theoretical psychologists who searched out new knowledge purely for its own sake.

Following is a list of major fields of psychology, with references to the chapters of this book dealing with each field:

Physiological Psychology concerns the structure and function of sense organs, nervous system, muscles, and glands underlying all behavior. Classic work in this field is described in the chapter called Bodily Bases of Behavior.

Comparative Psychology deals with animal behavior. Some of its major findings are described in the chapters on Motivation, Emotions, Learning, and Bodily Bases of Behavior.

Developmental or Genetic Psychology studies the behavior changes occurring from birth, through childhood, adolescence, and maturity to senility. It is discussed in Individual Development, Intelligence, Heredity and Environment, and How Personality Develops.

Child Psychology deals with human behavior from birth to about age 12. Overlapping developmental psychology, it is taken up in the same chapters.

The Psychology of Personality treats individuality, or one's pattern of behavior as a whole. Two chapters are devoted to this: Measuring Personality and How Personality Develops.

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Abnormal Psychology is the study of mental diseases and minor behavior peculiarities. Three chapters take up the abnormal: Mental Disease, Conflicts and the Unconscious, and Feeble-mindedness and Genius.

Social Psychology deals with the ways a person influences others and is influenced by them. The chapter called Man's Social Behavior describes major contributions to social psychology.

Differential Psychology concerns differences in the behavior of one individual compared with another, or of one group compared with another. As differences are best revealed by tests, the chapters on Intelligence and Intelligence Testing, Measuring Specific Aptitudes, and Measuring Personality center about differential psychology. So does the last part of Man's Social Behavior, which discusses differences between sexes and between races.

Applied Psychology is devoted to solving practical problems. Its most important subdivisions are educational, clinical, industrial, advertising and selling, personnel, vocational, and legal psychology. Some outstanding discoveries in these fields are described here and there throughout the book, and more fully in the last chapter, Psychology in Everyday Life.

Schools in Psychology

In a young and growing science internal disputes often occur. Psychology is no exception. Psychologists have differed about what psychology should or should not include, about what it should emphasize, about what research methods are best. When several psychologists strongly support a certain viewpoint they are called a "school." At present no active schools exist, but the period between 1900 and 1930 saw five important schools.

Structuralism traces back to two men, WILHELM WUNDT and EDWARD BRADFORD TITCHENER. Wundt is regarded as the father of experimental psychology since he established in 1879 at Leipzig, Germany, the first psychological laboratory. To study with Wundt came young and eager psychologists from many coun-

tries. One of these was Titchener, an Englishman, who later came to America to head the psychology department at Cornell University for many years.

Following out Wundt's basic ideas, Titchener established the school known as structuralism. Psychology is concerned with studying images, thoughts, and feelings, the three elements forming the structure of consciousness. The proper research method is introspection, performed by trained observers. Learning, intelligence, motivation, personality, or abnormal and social behavior Titchener ruled out of psychology. He and his students did notable laboratory studies, some of which are described in the chapters on Bodily Bases of Behavior, Perceiving, Thinking, and Imagery.

Functionalism is a less systematic and unified school. It grew out of the protests of many psychologists against analyzing consciousness into ideas, images, and feelings. The Danish psychologist HARALD HÖFFDING, and the American WILLIAM JAMES both emphasized the dynamic, changing nature of mental activity and questioned whether it could be analyzed into structural elements. Shortly after 1900 JOHN DEWEY and JAMES ROWLAND ANGELL at the University of Chicago began to stress the ways in which an organism adjusts to environment. Their aim in studying mental functions was to discover how thinking, emotion and other processes fulfilled the organism's needs. The views the functionalists helped to align psychology with biology and bring about a genetic approach to psychological problems.

Behaviorism was founded about 1914 by JOHN B. WATSON, then an animal psychologist at Johns Hopkins University. He too was impatient with the narrowness of structuralism, but he did not feel that the functionalists went far enough in their criticisms. Watson objected particularly to introspection, which he considered unscientific. Psychology's real concern, he said, is to study *behavior*, not consciousness. Expose an animal or a human

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being to a stimulus and see how he responds; record this behavior objectively and you have real scientific evidence. Watson and his fellow behaviorists experimented on learning, motivation, emotion, and individual development.

Gestalt Psychology was a reaction against both structuralism and behaviorism. WOLFGANG KÖHLER and KURT KOFFKA, the leading Gestaltists, said experience and behavior cannot be analyzed into elements of consciousness, as claimed by the structuralists. Nor can it be broken down into stimulus-response units, as the behaviorists seemed to think. Behavior and experience are unanalyzable wholes, though certain relationships between the whole and its parts can be discerned. The Gestalt experiments are described in our chapters on perception, learning, and thinking.

Psychoanalysis stood apart from the other schools. Founded by a physician, SIGMUND FREUD, it grew out of his effort to cure persons suffering from mental and nervous disorders. Psychoanalysis presents amazingly fruitful and provocative theories of motivation, of personality development, and of abnormal behavior. Unlike other founders of schools, Freud made no effort to verify his theories by scientific experiment. Freud's major interpretations and those of his dissident disciples are presented in the chapter called Conflicts and the Unconscious.

Is Psychology Just "Common Sense"?

Why should psychology be called a science? Isn't knowledge about human nature—isn't the understanding of human behavior—a matter of plain ordinary common sense?

Not necessarily. Consider the following example. A few years ago Floyd Ruch, a well-known teacher of psychology, gave a "test of common sense" to large classes of university students just before they began the study of psychology. The students were presented with a series of statements and asked to answer "True" or "False" to each. Some of the statements were:

The marriage of cousins is practically certain to result in children of inferior intelligence.

Long slender hands indicate an artistic temperament.

Adults sometimes become feeble-minded from over-study.

Emotional expression in another person can be judged more accurately from the eyes than from the mouth.

If you stare at a person's back you can make him turn around. This is a form of telepathy.

Especially intelligent children are likely to be weak and retarded physically.

All of these statements are false, as is shown by careful investigation. Yet more than half of the college students applied the comment "True" to each statement.

Common sense observations often are superficial and untrustworthy. Knowledge about human behavior requires a more factual foundation than common sense.

The Nature of Science

We have called psychology a science. Is this correct? Astronomy, chemistry, and physics are readily recognized as sciences; they involve careful laboratory work, exact measurement, rigid laws, and sure-fire predictability. Psychology is concerned with something less definite and tangible; exactitude is hard to obtain and exceptionless laws almost never occur.

However, it is not the definiteness of its material which determines whether a subject is a science. (If it were, biology might be excluded since it studies the great unknown—life.) KARL PEARSON, an English mathematician and scientist, insisted nearly fifty years ago that the criterion of science is not subject matter

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but the methods of investigation used. If scientific method is used systematically, we may properly speak of a science, whether the object of study is minerals, bacteria, human thoughts and feelings, or social institutions.

Scientific method is no mystery. It is a definite procedure used in trying to answer a question or solve a problem. The problem may be a practical one like "What causes malaria?", "What causes mental disease?", "How does alcohol affect behavior?" Or the problem may be inspired by mere curiosity: "Why do objects fall to the earth?", "How does heredity work?", "Can animals learn?"

The first step is to discover what other attempts have been made to answer the question. Why did they fail? Out of this knowledge emerges a new hypothesis or theory which can be tested by experiment.

Experimentation is the crucial step in scientific work. Essentially it is asking a question of nature. It means setting the stage in such a way that the events which follow will provide a meaningful answer.

Medical research into the cause of yellow fever furnishes a good example of hypothesis and experimentation. According to one theory, it is a contagious disease; this was shown to be wrong. According to another theory, the disease is carried by rats; this too was found to be incorrect. A new hypothesis attributed the cause to mosquitoes.

To test this hypothesis a group of men were exposed to mosquitoes known to have bitten yellow fever patients. Most of the men became ill. As a check a "control" group was used for comparison—men exposed to all other possible causes of the disease, except mosquitoes. None in the control group contracted yellow fever. The evidence was clear: yellow fever is transmitted by mosquitoes.

As a precaution against chance errors experiments are often

repeated, using different groups of subjects. If the results agree, the proof is doubly sure.

The ultimate test of scientific discovery is prediction. A principle in chemistry or physics has a predictability of practically 100%. In biology it is not as high; we cannot say, for example, that everyone bitten by a mosquito carrying malarial germs will get the disease; a few don't. In psychology and the social sciences predictability is almost never perfect because of the complexity of human behavior. If an experimental finding enables us to make a prediction that is substantially better than a mere guess, it is considered worthwhile.

A Psychological Experiment

Few psychological experiments are as clear-cut as the precise laboratory studies of physicists, chemists, and biologists. They are more difficult to plan, execute, and interpret. But they follow the same principles of scientific method: studying the data, forming hypotheses, testing them by experiment, checking and verifying, and predicting.

A few years ago a new drug called benzedrine appeared on the market. It was said to have a certain exhilarating effect over short periods. College students began to take benzedrine before exams, reporting it kept them awake and made them think more clearly. Psychologists looked into the subject and decided to see whether benzedrine actually steps up mental ability.

Many subjects were used. Two equivalent forms of a comprehensive intelligence test were given, one before and one shortly after the drug was administered. To eliminate possible influences of suggestion or expectation (like one's expectation that coffee will keep one awake at night) another group of subjects was used; these persons took a "placebo"—a flour-and-water tablet identical in appearance with a benzedrine tablet. In this way differences between performance of the benzedrine and placebo groups could be attributed to genuine effects of the drug.

Results showed that, despite many subjects' reports of feeling "pepped up," benzedrine failed to affect mental ability significantly. The results of several independent investigations verified this finding. It is possible to predict, therefore, that benzedrine will not have a noticeable effect on the mental performance of most persons.

In all sciences, unfortunately, scientific procedure sometimes is violated. An investigator's bias occasionally creeps in to prejudice results. Too few subjects to justify conclusions may be used. Careless measurements and calculations have been known to occur. On the other hand, scientists keep errors at a minimum by checking each other's work constantly and by repeating experiments whose results seem doubtful.

Certain studies are called "pseudo-sciences" because validity is claimed for their findings but no effort is made to use scientific procedures. For example, the astrologist says ability and personality are determined by planetary conditions. But he produces no proof. The proof, of course, would be to show that persons born at the same time have similar personalities, in contrast to persons born at different times. This has never been demonstrated. Until it is, astrology cannot be considered a legitimate science. The same is true of phrenology, which interprets personality by bumps on the head; of physiognomy, which reads character from facial features; and of graphology, which bases its interpretations upon certain characteristics of a person's handwriting.

Special Psychological Methods

When they experiment, psychologists use one or more of four methods. These methods are:

1. *Introspection.* Here a subject reports his own inner experience. If shown two designs and asked which he prefers, he gives his own subjective report. Probably he tells the truth, but verifica-

tion is impossible. His word must be accepted. Or he may be asked to solve a problem, then told to describe how he solved it. This too is introspection. Despite its subjective nature, introspection yields evidence that can be obtained in no other way.

2. *Objective Method.* In contrast to introspection, which deals with inner experience, the objective method notes outward behavior. It can be observed, checked, measured, and photographed. When a person releases a key as soon as he sees a light, he indicates his "reaction time," or speed of response. With proper apparatus this can be measured in thousandths of a second. Snapping a picture of a subject's face just as a shot is fired records his startled reaction. Whenever possible psychologists investigate objectively, using apparatus for accurate recording.
3. *Statistical Methods.* Quantitative measurements customarily are used in psychological experimentation. Tests are scored in points, learning is judged by the number of units mastered in a given time, and problem-solving ability by the amount of time required to get the answer. Statistical techniques are essential in interpreting the results when many subjects are used. Calculating averages is a simple and commonly used statistical procedure.
4. *Case Study Method.* To deal with the personality of a single individual, as in clinical work, the psychologist must know the subject's whole background. The case study, which records a person's life story, makes it possible to understand the

major forces and influences shaping his development.

Often a combination of methods is used, as we shall see in the chapters which follow. In experiments on thinking, for instance, objective data may be obtained and these results supplemented by introspections. The use of both objective and statistical procedures in an investigation is also common.

CHAPTER II

Intelligence and Intelligence Testing

BINET EBBINGHAUS CATTELL GODDARD
STERN TERMAN PINTNER PATERSON
YERKES THORNDIKE MILES SPEARMAN
THURSTONE JONES SHERMAN



What is intelligence? What is an I.Q., and how is it measured? Do intelligence tests give a real index of a person's mentality? Where are intelligence tests used? What are their drawbacks? Does intelligence change with age? Can adults learn as quickly as children? Is intelligence mainly inherited, or can it be changed materially by environment?

AT SCHOOL or at our work most of us take at least one intelligence test. The test reveals something about our capacity to learn, our adaptability, retentiveness, and ability to apply knowledge in solving problems. Intelligence is not identical with book learning, yet most educated men and women are intelligent. Intelligence is not a guarantee of success, but unsuccessful persons often are unintelligent.

To a psychologist the word "intelligence" has a somewhat different meaning from that given it in general usage. Until the nineteenth century "intelligent" and "intellectual" were used almost interchangeably, and both referred to the ability of human

beings to think, as opposed to animals which were considered creatures of instinct.

Darwin's momentous theory of evolution changed all this. It closed the gap between man and animal; the two were seen to be related. Darwin and his successors pointed out similarities between the behavior of man and that of lower animals. Instincts were discovered in human beings, and signs of intelligence in animals. Intelligence came to be regarded as a certain kind of behavior, not necessarily synonymous with intellect.

The first "mental tests" did not measure intelligence, but gauged an individual's performance in simpler sensory and motor processes. JAMES McKEEN CATTELL went to Germany in the 1880's to study under the famous Wilhelm Wundt. At Leipzig, Cattell became interested in individual differences. Returning to America he devised several mental tests which he gave to his students at Columbia University. These included strength of grip, rate of tapping, reaction time to sound, speed of naming colors, and memory span for letters. Hugo Münsterberg at Harvard and Joseph Jastrow at the University of Wisconsin also devised and administered similar tests. Though not called intelligence tests, all were supposed to measure the mind in some way; they were the first step toward valid measures of ability.

The Binet Tests

Shortly before 1900 HERMANN EBBINGHAUS, a German noted for his work on memory, brought forth a theory that intelligence is the ability to combine and integrate, and that it could be tested with sentences containing blanks which must be filled in to complete the sense. "The — rises — the morning and — at night" illustrates the kind of test sentence he recommended. Evidence supported his theory; when he gave such tests to school children, older ones did better than younger, good students better than poor ones.

The father of intelligence testing, however, is not Ebbinghaus,

but a Frenchman, ALFRED BINET. Binet disagreed with those who sought to measure general ability by testing speed of reaction, rote memory, sensory acuity, or muscular movements. Intelligence can be estimated, said Binet, only by tests of higher faculties like reasoning, comprehension, judgment, adaptability, persistence, and self-criticism.

In 1904 Binet, appointed to a national educators' committee to investigate retardation in French schools, put his ideas into concrete form. Collaborating with Théophile Simon, he published the first intelligence test. In it are thirty items arranged in order of increasing difficulty. Among them are: following a moving object with the eyes, recognizing food and simple objects in a picture, comparing two lines of different lengths, repeating spoken sentences, memorizing things in a picture, finding rhymes for a given word, completing sentences, defining abstract terms.

Binet tried out these tests on children, and in 1908 published a revised scale which divided the tests into age groups from 3 to 11 years. At some age levels only three questions were asked; at others, 5 or 6. For example:

Age 3: Point to nose, eyes, mouth.

Age 5: Copy square; count four coins.

Age 7: Tell what is missing in unfinished picture.

Age 10: Repeat months of year.

Age 13: State differences between pairs of abstract terms.

With this scale Binet introduced the concept of mental age. A child who passed all or all but one of the tests for, say, age 7 was given a basal mental age of 7. If he passed five or six tests at higher age levels he was credited with another year of mental age.

In 1911, shortly before he died, Binet published a second revision of his scale. It omitted certain test items previously included, added others, and brought the scale up to the adult level. In this edition Binet included five tests for each age, except the

4-year level. The 1911 scale, validated and standardized, represented a great improvement over the earlier two series.

The Goddard Revision

HENRY H. GODDARD, psychologist at the Vineland Training School for Feeble-minded, began to use Binet's test soon after it first appeared in France. He found it useful in detecting mental deficiency in children and also in distinguishing between various degrees of feeble-mindedness. However, the Binet test had to be slightly adapted and modified for American use. This adaptation and modification Goddard accomplished by trying out the 1908 scale on many hundreds of school children. He published his revision in 1910, translating Binet's scale into English and changing the wording and order of several test items.

Goddard's revision was used widely during the next few years, though chiefly to detect mental deficiency rather than to study the intelligence of normal or superior children.

Terman and the Stanford Revision

A tremendous advance in intelligence testing came with the work of LEWIS M. TERMAN, psychologist at Stanford University. For several years before publishing his book, *The Measurement of Intelligence* (1916), Terman and his colleagues worked at standardizing and validating the Binet test.

Terman tested 2,000 school children to discover just what a normal child at any given age can do. He chose six tests for each year from 3 to 10 inclusive, also for ages 12, 14, 16, and 18. His calculations indicated that an average adult has a mental age of 16 years while a superior adult has one of 18 years. By using six tests for each year he was able to give two months mental age credit for each test passed. Many of Binet's items were included, though some were shifted to higher or lower age levels, according to Terman's findings on normal children. Several new test items were added, so that the Stanford revision (including alternate

items) totaled ninety tests, compared with fifty-four in Binet's 1911 scale.

Binet had introduced the idea of mental age. A German psychologist, WILHELM STERN, suggested in 1912 that a child's relative superiority or inferiority could be calculated by dividing his mental age by his chronological age. Stern called this the "Intelligence Quotient." Terman adopted the idea, and the abbreviation "I.Q." was accepted to designate a child's mental ability.

It is calculated thus: If a child to be tested is 7 years 1 month old, the tester might start by giving tests at the 6-year level. Suppose the child passes all the tests for age 6, four for age 7, three for age 8, one for age 9, and none for age 10. The child's mental age (abbreviated "M.A.") is obtained by crediting him with 72 months for passing all tests at age 6 (and presumably all under age 6), plus 8 months at age 7 (4 out of 8 tests), 6 months at age 8, and 2 months at age 9. His total M.A. in months is 88. His chronological age in months is 85. His I.Q. therefore is $88/85$. To remove the decimal point, the result is multiplied by 100; therefore this child's I.Q. is 104.

Suppose the child's chronological age (abbreviated "C.A.") were 8 years 6 months; and his mental age the same as above—88 months. His I.Q. then would be $88/102$, or 86. I.Q.'s near 100 are considered normal because mental age corresponds with chronological age. As we shall see presently, I.Q.'s below 70 definitely are inferior; those above 130, quite superior.

Terman's "Stanford-Binet" test is given by a trained tester to one person at a time. It is important that the tester learn to give and score tests in a uniform standardized fashion, so I.Q.'s are comparable. The tester must also be trained in the ways of gaining a child's cooperation, so the test represents the child's best effort. The decade following 1920 saw hundreds of testers trained and thousands of children's and adults' I.Q.'s computed.

After twenty years' experience Terman, assisted by Maud A. Merrill, issued the 1937 revision of the Stanford-Binet test, ex-

tending the scale down to 2 years, and including many more items at upper levels. Two equivalent forms of the test were devised so a child can be re-tested without using the same material.

Thanks to Terman's work the I.Q. is accepted as a measure of general mental ability, though not without criticisms. These criticisms will be discussed later.

Performance Tests

Given to one person at a time, the Binet type of test depends for its validity upon normal vision, hearing, muscular control, and comprehension of language. To test blind or deaf persons, illiterates, or those who speak very little English, it is unsuitable. Performance tests were devised to meet these special conditions.

About 1850 a great French physician, Édouard Seguin, constructed a kind of test for feeble-minded children. It consisted of fitting blocks of various shapes, such as a star, triangle, cross, square, or circle, into corresponding cut-outs in a board. By pantomime the child could be shown how to put each block in its proper hole. Later, Doctor William Healy of the Judge Baker Foundation in Boston arranged a completion test. In this the child was shown a farmyard scene out of which were cut several square holes. From many pieces that would fit the holes he had to choose those that made best sense in completing the picture.

Two psychologists, then at Ohio State University, RUDOLF PINTNER and DONALD PATERSON, taking over the Seguin, Healy, and other similar tests, prepared the first performance scale in 1917. In this series all the tests call for a motor response (that is, responses involving movement), such as putting together a puzzle, fitting blocks into place, or imitating the tester in tapping cubes. Verbal directions are unnecessary. Tests are scored in terms of time taken and moves or errors made.

While performance tests are useful with persons having sensory or language handicaps, they do not test quite the same thing as verbal tests. In actual practice, if a child is considered unfairly

judged by the Binet test it is wise to give a performance test. If his M.A. shows a pronounced rise in the latter, probably the verbal test did not measure his ability accurately.

Army Alpha and Beta

The year after Terman's Stanford-Binet test appeared the United States entered World War I. A critical need arose to sift out from the thousands of draftees those mentally unfit and, at the other extreme, to discover men best qualified for officer training. At once the American Psychological Association appointed a committee of experts to draw up a test that could be taken by many persons simultaneously. Professor ROBERT M. YERKES of Yale was named chairman; members were Lewis M. Terman, Arthur S. Otis, Henry H. Goddard, Frederic L. Wells, Walter V. Bingham, Guy M. Whipple, and T. H. Haines.

In framing the new group test the committee made every effort to reach innate ability, keeping the test (so far as possible) independent of education or other training. Two tests resulted, Army Alpha for literates, and Army Beta for illiterates or persons with meager knowledge of English.

Army Alpha consists of eight sections, each containing 12 to 40 questions. Every section begins with easy questions and progresses to harder ones, so that all persons can answer some questions, but few can answer all. Test One involves following directions read aloud by the examiner. For example, the following figure appears on the test sheet:



The examiner says: "Attention! Look at question 2 where the circles have numbers in them. When I say 'go' draw a line from circle 2 to circle 5 that will pass under circle 3 and above circle 4. —GO."

Test Two presents 20 arithmetic problems, such as "If an aero-

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plane goes 300 yards in 10 seconds, how many feet does it go in a fifth of a second?"

Test Three requires common sense judgments; the best answer of three is to be selected in each case. To illustrate: "Every soldier should be inoculated against typhoid fever because

- 1—many men have typhoid fever
- 2—the doctors insist on it
- 3—it prevents epidemics."

In Test Four one must decide whether 40 pairs of words are the same or opposite; e.g. fault-virtue, agitate-excite.

Test Five offers jumbled sentences to be rearranged sensibly: "made cloth wool cotton and is from."

Test Six requires completion of number series like:

3 - 4 - 6 - 9 - 13 - 18 - — - —

Test Seven, the verbal analogy test, involves seeing relationships. Forty examples such as these are presented:

skirts—girl :: trousers—boy hat vest coat
mayor—city :: general—private navy army soldier.

Reading "skirts is to girl as trousers is to *what?*" the testee underlines the word out of the four at the extreme right that bears the proper relationship to word three.

Test Eight calls for general information by asking for identification of the correct word:

Rio de Janeiro is a city of:
Spain Argentina Portugal Brazil

The volt is used in measuring:
electricity wind power rainfall water power

Only 24 minutes' working time (excluding directions) is allowed for the eight tests.

Maximum score on Army Alpha is 212 points. Over 135 is excellent, 105-134 is good, and 45-104 is fair. Nearly all officers rated above 105; enlisted men averaged a little below 60.

Army Beta also is a paper and pencil test, but directions are given by pantomime or demonstration. It includes tracing a line through mazes, counting blocks in given piles, completing patterns of X's and O's, substituting symbols for numbers, noting similarities and differences in two sets of figures, completing pictures by supplying parts omitted, and solving simple geometrical puzzles. While Army Beta did not test exactly the same abilities as the verbal Alpha test, it helped discover men of good intelligence whose Alpha performance was bad because they lacked schooling or command of the English language.

More than a million and a half recruits took the Alpha test in 1918 and several thousand took the Beta. The tests helped enormously to separate satisfactory from unsatisfactory soldiers. At the same time they supplied psychologists with valuable information about intelligence and its testing. Shortly after the war many other group tests were devised; they have come to be used widely in schools and in business and industry.

When the draft began before we entered World War II, Army Alpha and Army Beta were supplanted by the General Classification test. Only three types of problems are included: arithmetic, vocabulary, and cube analysis or block counting. This general ability test is supplemented by various special aptitude tests whose exact nature is not yet disclosed.

How Good Are Intelligence Tests?

Whether or not intelligence tests really measure mental ability was hotly disputed in the years just after Binet's tests appeared. Scores of psychologists checked the validity of I.Q. ratings by looking for answers to these questions: Do teachers' estimates of students' ability agree with test scores? Do children who excel in

school work also rate high in tests? Do those whose behavior shows them to be deficient rate low? Do more older than younger children answer a given test question correctly, since a child's mental ability can be assumed to increase with chronological age? And finally, do results of several different intelligence tests agree in ranking an individual's ability high, medium, or low?

All such check-ups show intelligence tests to be valid. Teachers' ratings and I.Q. scores agree rather well. Children doing good school work generally have high I.Q.'s. Goddard and his successors, working with the feeble-minded, found that the tests discriminate well between normals and deficient. Binet and Terman found their tests passed by increasingly greater percentages of older than of younger children. For example, a Terman test at the 7-year level asked the child to repeat after the tester five digits. Children between 5 and 9 years passed the test in the following percentages:

AGE	5	6	7	8	9
PER CENT	34	59	74	83	93

Comparing I.Q.'s obtained from several verbal type (e.g. Stanford-Binet) tests reveals that the scores agree significantly. Agreement between the scores of verbal and of performance (e.g. Pintner-Paterson) tests, though positive, is less striking.

All of these check-up methods, taken singly, are subject to error; but their consistently positive results indicate that intelligence tests do measure mental ability fairly accurately.

Intelligence tests have been criticized severely. Minor criticisms, as of certain test items and procedures, often resulted in revisions and improvements of the tests. In 1937, for example, Terman revised his Stanford-Binet test and put out two alternate forms of the new scale, which are greatly superior to the 1916 edition.

Other criticisms are more fundamental. It is said that the tests fail to get at native inborn ability, that a child's performance and

resulting I.Q. are affected greatly by his home background and other social factors. This is true; many comparisons between individuals or between groups are invalid because of their differences in backgrounds and experiences. On the other hand, when children having reasonably similar environments are tested together, such as pupils in a small town school, intelligence test ratings give a fair measure of the children's relative abilities.

EDWARD L. THORNDIKE, of Columbia University, and others objected to the assumption that any test can measure "general intelligence." In his *Educational Psychology*, published in 1914, Thorndike questions the existence of general ability, stressing rather the "singularity and relative independence of every mental process." Instead of general ability there are many special or grouped abilities, he insists, such as mathematical or mechanical ability.

After making statistical studies of performance on many tests, an English psychologist, CHARLES SPEARMAN, concluded that each individual has a certain amount of general ability which enters everything he does, but that special abilities which vary for each task undertaken also exist. Performance on a mathematics test, for instance, depends on both a person's general ability and on his specific aptitude and training in mathematics.

Now most psychologists take a middle position between general and specific abilities. Several "group factors," or clusters of ability, have been found by analyzing carefully whole batteries of test results. This was done by Professor LOUIS L. THURSTONE, of the University of Chicago. Thurstone isolated certain "primary mental abilities," namely, visualizing, speed in perceiving, facility with numbers, memory, word fluency, verbal comprehension, and two or three factors related to reasoning. The abilities are relatively independent; a person proficient in one is not necessarily so in another.

Although some doubt remains about the existence of a "general ability" that enters all our activities, clusters of ability clearly

do exist. In time we may cease to use any single index of ability, like the I.Q., but will speak instead of separate abilities in mathematics, language, memory, reasoning, and the like. Thurstone and his co-workers are trying to perfect tests which will measure accurately each primary mental ability. If this is done we can determine which abilities are most closely related to success in school and in the various vocations. An estimate of "general ability" can still be obtained, however, by averaging scores on the separate ability tests.

Other critics rightly charge that intelligence tests leave untouched many important aspects of personality, like interests, motives, attitudes, or social adaptability. One must, however, recall that these tests do not pretend to measure personality. In fact, no one test ever has been devised—and perhaps never will be devised—that measures all aspects of personality. The best procedure, when a complete personality picture is desired, is to make a case study of an individual's background and experience, and to supplement it with a variety of tests, not only those measuring intelligence, but also those measuring special aptitudes, achievements, interests, attitudes, and other phases of personality. We shall consider these tests in later chapters.

Whatever may be said for or against intelligence tests in the future, they now have practical value in several fields. Employers use them to help choose the ablest applicants for jobs. The army, navy, and air force give a comprehensive intelligence test to every new recruit. Teachers use tests to classify pupils in advanced, average, or retarded sections, and to arrange courses of study suited to individual abilities. Vocational guidance and personnel workers find them helpful in determining occupations for which students or employees are best fitted. Probably their use can be extended still further. As Pintner points out, even today thousands of workers are misfits in their jobs, some bogging down under work they are incapable of handling, others dissatisfied

with tasks far below their capacities. Through the use of intelligence tests some of these situations could be avoided.

Intelligence of the American Population

Terman revised Binet's test so that the average person, having a mental age similar to his chronological age, would obtain an I.Q. of about 100. After the Stanford-Binet test had been used a few years it became customary to consider persons with I.Q.'s below 70 as mentally deficient, those between 85 and 115 as normal, and those above 130 as very superior. The intelligence of the American population is distributed roughly as follows:

I.Q.	CLASSIFICATION	APPROXIMATE PERCENTAGE OF POPULATION
150 and over	Near "genius"	.2
130-149	Very superior	3.0
115-129	Superior	14.0
85-114	Normal	66.0
70-84	Dull	14.0
50-69	Moron	3.0
20-49	Imbecile	
Below 20	Idiot	

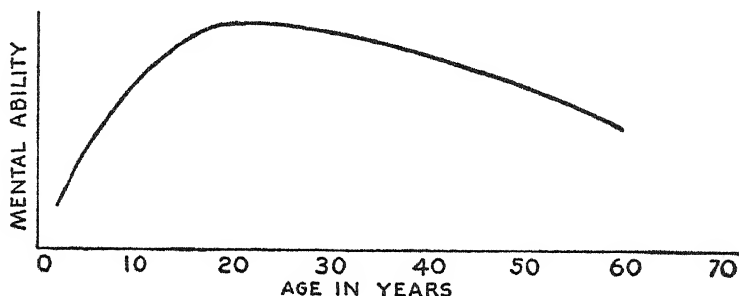
Of course no hard and fast lines divide the categories. No real difference can be noted between persons having I.Q.'s of 114 and 115, or between those having 69 and 70. Every degree of intelligence from the lowest idiot to the greatest "genius" is found among our population.

How Does Mental Ability Change with Age?

Many persons were shocked when Terman announced that the average adult intelligence is equal to that of a 16-year-old. Even more shocking was the fact that Army Alpha tests placed the level at 14 years. (Terman's most recent estimate is 15 years.) People forget that psychologists define intelligence as capacity to learn, adaptability, and mental alertness. In the tests, knowledge, information, and experience are kept at a minimum, though these factors are bound to affect performance.

Mental ability, as measured by intelligence tests, hits its peak for most persons somewhere between ages 14 and 20. The newborn child progresses very quickly. In the first 4 or 5 years he gains more than at any other period in his life. After reaching its peak level mental ability declines slowly until old age, according to investigations by Thorndike and by WALTER R. and CATHERINE C. MILES, former California psychologists now at Yale University.

Graphically the curve of mental growth appears thus:



Note that no great decline appears in the curve before age 50; even then it is not marked. This curve represents an average individual. For superior persons it rises higher and drops off a little more gradually. For persons below average in ability it reaches a lower peak and declines somewhat faster.

HAROLD E. JONES and HERBERT S. CONRAD, of the University of California, revealed a great discrepancy in the performance of different age groups on tests depending largely on knowledge (e.g. vocabulary) and tests primarily measuring alertness (e.g. following directions). The *knowledge* curve remains almost level between ages 20 and 60, while the *alertness* curve declines gradually after age 17.

In these studies of the relation between age and mental ability it is comforting to note that alertness decreases very slowly until after middle age. A parent of 40, though past his own peak of mental alertness, can learn new things about as well as his young-

ster of 13 who has not yet reached his maximum. In fact the adult can learn them better if he is motivated strongly enough to make up for his slight inferiority in alertness and adaptability.

Irving Lorge has shown that the greatest difference in mental ability between younger and older persons lies in speed rather than accuracy or "power." A group of persons under 25 and a group over 40 did equally well on a test that had no time limit. When tests with a time limit, like Army Alpha, were used, the younger group showed a clear superiority because its members could work faster.

Influence of Education on I.Q.

As we shall see in Chapter V, individual differences in intelligence are determined chiefly by heredity. Environment, however, has some effect. Because it can be changed more easily than heredity, it is important to know which environmental factors most influence intelligence, even though their effect is relatively small.

Of these environmental factors, education is regarded by many psychologists as the most significant. Horatio H. Newman, Frank N. Freeman, and Karl J. Holzinger, of the University of Chicago, found that when identical twins reared apart differed in I.Q., the twin with the higher I.Q. had had the better education. Several University of Iowa psychologists claim that good educational opportunities can increase the I.Q. by ten or more points, though others doubt that the effect is so great. Army mental tests consistently show that soldiers with more schooling get higher scores than those with less.

In general, city children do better than country children on intelligence tests. Lewis Terman and Maud A. Merrill in their 1937 volume, *Measuring Intelligence*, report an average I.Q. difference of $6\frac{1}{2}$ points in favor of urban children. Other psychologists have found greater differences. It is significant that the rural child's inferiority is greatest where the school system is

poorest. In Scotland, where the rural schools are good, country children show no inferiority.

Besides differences in educational opportunity another factor enters into the poorer performance of country children. Usually the materials used in test questions are more familiar to city children, giving them an advantage. Thus discovered differences may result from failure of the tests to provide a fair measure of ability in both cases.

Effect of the Home

Another major environmental factor affecting I.Q. is the home in which a child lives. Frank N. Freeman and two associates found that foster children placed in superior homes gained 5 to 10 I.Q. points after four years, whereas those placed in less desirable homes gained little or nothing. Probably the most striking influence of home environment was reported by J. Munroe at the University of Chicago. He tested many children at intervals between first grade and completion of high school. Five workers rated each child's home on the basis of food, health, parental education, father's occupation, and social, cultural, and religious aspects. The quality of the home correlated significantly with I.Q. changes which occurred. Children from homes with low ratings showed a loss in intelligence, whatever their initial I.Q. had been; in one case the loss was 47 points. Children from the better homes gained as much as 20-odd points. From his study Munroe concluded that the home can cause really large variations in a child's I.Q.—as much as 20 or 25 points up or down the scale.

Again, as with rural-urban differences, these variations may be caused, at least in part, by failure of the test to provide materials equally familiar to children in both kinds of homes. In this case the differences revealed would not give an accurate estimate of differences in ability.

Occupation and I.Q.

Persons in different occupations vary markedly in intelligence test performance. In the Army Alpha tests, professional men—engineers, doctors, lawyers, teachers, and business executives—ranked highest. Next were bookkeepers, clerks, photographers, and skilled tradesmen. Then came carpenters, policemen, printers, farmers, and shopkeepers. In the lowest group were store clerks, cooks, fishermen, firemen, barbers, and day laborers.

With children of persons in different occupations the same is true. Studying almost 3,000 children, Terman and Merrill found the following results:

FATHER'S OCCUPATIONAL LEVEL	CHILDREN'S MEAN I.Q.
I. Professional	116.2
II. Semi-professional and managerial	111.9
III. Clerical, skilled trades, retail business	107.5
IV. Semi-skilled, minor clerical, and business	105.0
V. Slightly skilled and unskilled	97.2

FLORENCE L. GOODENOUGH, of the University of Minnesota, investigating younger children, reported slightly higher I.Q.'s, but found the same relationship between I.Q. and parental occupation.

Average intelligence in children of professional parents is high. I.Q. decreases as one moves down the occupational scale to unskilled labor. There is, however, much overlapping; i.e. some children of professional parents are lower than some children of semi-skilled and unskilled parents.

Psychologists agree that persons in professional and executive positions are a selected group in terms of intelligence, and this high ability is transmitted by heredity to their children. But their superior environments also play a part, as was shown clearly in a recent study by Nancy Bayley, of the University of California. The intelligence of children under 2, she found, is not related to the income, occupation or socio-economic status of their parents. From age 2 to age 10 there is an increasing tendency for high

intelligence to be correlated with high income and superior social and economic status. In other words these environmental factors help to determine I.Q. by making themselves felt increasingly as the child grows older.

Socio-economic and Cultural Factors

An English school inspector, HUGH GORDON, reported in 1923 on the intelligence of canal-boat and gypsy children. Both these groups had poor socio-economic and cultural backgrounds and were isolated from normal social contacts. At most they had only two or three months of schooling a year. Average I.Q.'s of both groups were about 70. The youngest children, however, were only slightly below normal; as they grew older their unstimulating home environments and lack of education operated to lower their I.Q.'s, sometimes so far that they were classed as mentally deficient.

MANDEL SHERMAN, another University of Chicago psychologist, with an assistant studied the intelligence of children in four mountain hollows of Virginia, comparing them with children in a typical small town nearby. On every test, both verbal and performance, the children of the hollows were clearly inferior, though their inferiority showed more strikingly on the verbal tests. All came from the same racial stock, but great differences were found in the economic, social, and cultural life of the various communities. In two hollows, for example, life was very primitive; little or no education, religion, or social organization existed. Few if any residents could read or write. Communication with the outer world came only by mountain path or trail. As with canal-boat and gypsy children I.Q.'s went consistently down as the children grew older. At ages 6 to 8 the hollows children had I.Q.'s between 80 and 85; after age 12 their I.Q.'s averaged about 50.

Two other investigators have discovered the same loss in I.Q. as children grow up in isolated backward communities.

How do psychologists interpret these findings? Some, like Florence Goodenough, say that the low intelligence found in isolated communities occurs because the ablest people migrated elsewhere. (Students of migration are not agreed on this point, but present evidence does not justify a general statement that migrants are more intelligent than persons remaining at home.)

A second interpretation would claim that the unfavorable environment actually causes a loss in general mental ability. However, most psychologists hesitate to accept this view because intelligence tests do not measure pure native ability.

Hence the commonest explanation is this: children in isolated backward sections do not get the kind of experience in their homes, schools, and communities that normal American children get. Tests are standardized upon the performance of these normal children. As experience plays an increasingly greater part in the higher age levels of tests, the isolated children are at an increasingly greater disadvantage.

Whether or not environmental influences raise or lower a child's mental capacity, psychologists agree that they have a considerable effect upon his intelligence test performance. To obtain from test results an accurate estimate of ability we must make certain that our subjects have reasonably uniform environments, including homes, schooling, socio-economic background, and cultural experiences.

Fortunately the I.Q. fad, which raged during the 1920's and saw the term applied indiscriminately, has declined. Today intelligence tests are seen in wiser perspective. What they can tell and what they cannot tell about a person's capacities are well recognized. They do one thing only—indicate mental alertness and learning ability. They do not take into account personality, special aptitudes and achievements, social adjustment, or many other factors that make for success or failure in life.

CHAPTER III

Measuring Special Abilities

SEASHORE MEIER STENQUIST PATERSON
BINGHAM THURSTONE HEVNER McADORY
O'ROURKE MOSS STODDARD MILES



Does mechanical, musical, artistic, or scientific aptitude necessarily indicate a high I.Q.? How are special aptitude tests constructed? Does training affect the scores? When are aptitude tests used? Can one predict future occupational success on the basis of test results?

APART from our "general intelligence" all of us have certain special aptitudes that affect what we do in our personal or business lives. These specialized abilities have little relationship to I.Q. While a person of superior general ability usually has some particular talents, he may well be devoid of mechanical, musical, or artistic aptitude. While a majority of those having artistic talent are above average in intelligence, some of them are below par. It is impossible to predict general intelligence from a knowledge of special aptitudes, and vice versa.

Special abilities depend on both native capacity and training. Tests now exist which measure mechanical, musical, and artistic ability; also aptitude for clerical work, engineering, law, medicine, teaching, nursing, and science. Persons taking the tests are

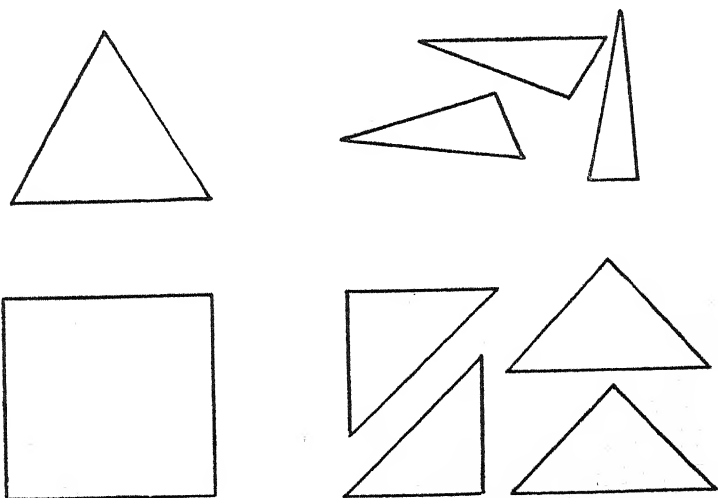
asked questions and given problems to solve that relate importantly to the field being considered.

Mechanical Ability

Tests of mechanical aptitude seek to measure skill and speed in perceiving mechanical relationships and in dealing with machines. JOHN L. STENQUIST, an American educational psychologist working on mechanical ability, devised a test that involves assembling the parts of ten small devices among them a bicycle bell, a push button, and a mouse trap. He found a high correlation between success in this test and success in shop work, which suggests that the test is a valid indicator. Performance on the test was largely independent of general intelligence.

Stenquist later drew up a paper-and-pencil form of his test, showing pictures of common mechanical devices, instead of presenting the gadgets themselves in a box. This group test measures mechanical ability almost as well as the individual assembly test.

DONALD G. PATERSON and four colleagues, using many measures, constructed the Minnesota mechanical ability tests.



They set up four criteria for mechanical aptitude: 1) quality of work done, 2) quantity done well, 3) creativeness in construction, and 4) critical appreciation, evaluation, and interest. The tests include assembling parts of gadgets, as in the Stenquist test, fitting cut-outs into corresponding holes in a board, and analyzing geometrical figures. The last-named test has several equivalent forms, in each of which the testee is asked to draw lines in the left-hand figure dividing it into the parts shown at the right. Examples are given on page 33.

The Minnesota psychologists found the tests most indicative when supplemented with ratings on interest and intelligence tests, with academic grades, and information about mechanical performance in the home, such as fixing light connections or leaky faucets. Performance on the tests was affected only slightly, they discovered, by environmental influences encouraging mechanical skill. However, older boys did better than younger ones, indicating that experience does affect ability. The popular notion that boys are natively superior to girls in mechanical ability finds no very definite support in the test results. Boys did better than girls in the assembly tests, but not in spatial relations or card sorting.

Mechanical aptitude tests are useful in vocational guidance. Of course not all persons who do well in the tests would be happy in mechanical or construction work; they might excel also in other types of activity. Furthermore, occupational interests do not always coincide with aptitudes. But one who does badly in the tests is not likely to succeed in these fields.

Musical Aptitude

One of the earliest special ability measures was the musical aptitude test, designed in 1919 by CARL E. SEASHORE, of the University of Iowa. It involves the use of six phonograph records, which test, respectively, the senses of pitch, intensity, time, rhythm, consonance and dissonance, and tonal memory.

On each record, subjects have to make from 50 to 100 comparisons between two notes or patterns of notes. The differences sometimes are great, sometimes exceedingly small. With pitch, for example, tone differences vary from 24 vibrations to only $\frac{1}{2}$ vibration per second. Musical persons judge nearly all correctly. Those having less aptitude make many errors. In each test, except that involving consonance, a judgment is either right or wrong. Correctness in the matter of consonance is determined by musical experts. In a 1939 revision of his test, Seashore substituted a more objective measure, "timbre," for consonance. Timbre refers to a tone's complexity in number and kind of overtones present.

On Seashore's test adults score somewhat higher than children but the difference is slight, and many children surpass the average adult. Seashore and others report that musical training affects scores very little. However, other studies show that training actually can improve pitch and rhythm discrimination.

Music teachers disagree about the value of Seashore's test. Some say it helps select satisfactory students for music schools and predicts their success rather accurately. Others contend that it overstresses mere sensory discrimination and fails to touch the essence of musical talent.

For eight years Hazel M. Stanton studied 600 college music students. Entering college all were given a musical aptitude and a general intelligence test. From the resulting scores they were classified into five groups: of the group scoring highest, 60% eventually received music degrees from the school; of the next highest group, 42%; of the third group, 33%; of the fourth, 23%; and of the lowest group, 17%. Though not based entirely on musical tests, these percentages show that success in music school can be rather accurately predicted before the student enters.

For predicting success in a music career (which depends on many factors besides aptitude) Seashore's test has not proved

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particularly reliable. However, it is safe to say that a poor score on the Seashore test argues strongly against taking up music professionally. A good score means that one has potentialities for creditable musical performance, at least as an avocation.

Several music appreciation and accomplishment tests have been brought out. The Oregon Music Discrimination Test, devised by KATE HEVNER, utilizes phonograph records of 48 short piano selections, arranged in pairs. One in each pair is part of a classic composition. The other is a changed version of the same in which melody, harmony, or rhythm has been altered. The person tested must choose the better composition (i.e., the original) and show how it was altered. Almost invariably those who do well on this test have a good deal of musical experience. However, some persons sensitive to melody may fail to discriminate subtleties of rhythm or harmony. The test gives a fair estimate of musical experience and appreciation.

Artistic Aptitude

Probably the best known test of ability in pictorial art was designed by NORMAN C. MEIER and CARL E. SEASHORE, of the University of Iowa. The test booklet contains 125 pairs of black and white pictures. One of each pair is a copy of a masterpiece—landscape, portrait, pottery, woodcut, or mural. The other, an altered version of the same, includes some change in position, shading, or perspective. Told how the pictures differ, the subject is asked which one pleases him more. A key gives the right answers, based on opinions of several art experts.

Another test of artistic appreciation, designed by MARGARET McADORY, comprises 72 illustrations, black and white and colored, each having four slightly different variations of the same theme. The pictures deal with furniture, utensils, textiles, clothing, architecture, painting, etc. Variations involve changes in shape, size, color, and shading. Persons being tested are asked

to choose the most pleasing design in each group of four. Besides a score on the total test, separate scores are obtainable for each type of subject matter treated.

On both these tests persons trained in art usually score higher than those who are untrained, though occasionally the opposite is true. Women surpass men, on the average, by a small but significant amount. Scores seem to depend partly on age, as well as on art training. Meier and Seashore interpret this to mean that the test does not mainly depend on training; artistic ability they consider a native "gift." From an extensive ten-year study recently completed, Meier found six so-called patterns important to artistic ability: manual skill, energy output, intelligence, perceptual facility, creative imagination, and esthetic judgment. The first three Meier considers mainly inherited, and the last three definitely influenced by heredity.

A number of psychologists disagree with Meier. They stress the importance of training in producing artistic ability. As with all aptitudes the relative weights of training and inheritance are hard to evaluate. But whatever the answer to this question, tests of musical and artistic talent are helpful, if used with caution, in curricular and vocational guidance.

Clerical Ability

In his book *Aptitudes and Aptitude Testing*, WALTER V. BINGHAM finds four kinds of ability underlying clerical aptitude: perceptual (ability to observe quickly and correctly), intellectual (ability to grasp meanings and make correct decisions), motor (ability to manipulate office equipment), and skills like arithmetic, spelling, punctuation, and good English usage.

Clerical tests measure one or more of these abilities. For example, LOUIS L. THURSTONE in 1922 published a group paper-and-pencil test, later revised and lengthened, which includes comparing and checking errors, solving arithmetic problems,

spotting misspelled words, listing names alphabetically, grasping meanings, and using English correctly. It also tests one's vocabulary and business information.

Many similar tests exist. LAWRENCE J. O'ROURKE, director of research of the U. S. Civil Service Commission, recently issued a junior grade clerical aptitude test. Divided into two parts—a reasoning test and clerical problems—it contains items like those described above. Donald Paterson and a student devised the Minnesota Vocational Test for Clerical Workers, using only two kinds of problems, comparing numbers and comparing names. Persons tested are instructed thus: "If the two names or the two numbers of a pair are *exactly* the same, make a check mark on the line between them; if they are different, make no mark on that line." Then follow 200 pairs of numbers and names, such as:

John C. Linder	_____	John C. Lender
5794367	_____	5794367

Score is determined by the number of items answered correctly. The whole test takes only about 35 minutes.

Persons holding clerical jobs generally score higher than others in these tests, which suggests that the tests do measure abilities important in clerical work. Employers seldom rely entirely on them in selecting clerical help, however. Many give a general intelligence test also, and require a transcript of school grades besides a personal interview with the applicant. In recent years, clerical aptitude tests have been quite useful.

Professional Aptitudes

The abilities one needs in order to make good as a court lawyer differ strikingly from those necessary for a corporation attorney. Similarly in the medical profession, a surgeon must have exceptional manual skill, while ability for detailed observation is necessary to the research man. These wide differences of talent required within any of the professions complicate the problem

of measuring professional aptitudes. However, tests exist for law, medicine, teaching, nursing, science, and engineering, and while not infallible they are usually helpful to college students in choosing their vocations. These tests are best used along with general intelligence and interest tests.

GEORGE D. STODDARD, now commissioner of education for New York State, with an associate constructed a law aptitude examination. Taken in an hour, it measures capacity for accurate recall, comprehension of difficult passages, reasoning by analogy and by analysis, and skill in logic. It has forecast success in law school rather well. Of students in the highest quarter of test scores, more than half received A or B in their first year law school work. Of the poorest half in test scores a large proportion failed on their courses.

Teaching demands general intelligence, a good grasp of subject matter, and certain desirable personality traits. To predict teaching success it is best to use one's I.Q. test score, school record, results of achievement tests in subjects to be taught, vocational interest findings, and a test of teaching ability.

A widely used measure of teaching aptitude is the Coxe-Orleans prognosis test of teaching ability, designed by two educational psychologists, Warren W. Coxe and Jacob S. Orleans, to select the most promising candidates for normal schools. A three-hour test, it consists of five parts: general information, knowledge of teaching methods and practices, grasp of professional material, reading comprehension, solution of educational problems.

While this test predicts better than do high school marks a person's normal school achievement, it does not predict better than a good group intelligence test.

The Stanford educational aptitude test, devised by Milton B. Jensen, estimates fitness for teaching, school administration, or educational research. In questionnaire form it presents problems for which the student chooses one of several solutions, and rates

his confidence in his own judgment. Three types of material are included: position preference ratings (in which the more attractive of two hypothetical positions is chosen), discipline problems, and high school activities. To validate the scale, successful teachers, administrators, and researchers were given the test. Students' performances are matched with these to determine in which field their greatest aptitude lies.

Professor FRED A. MOSS, of George Washington University, developed a scholastic aptitude test for medical schools. A paper-and-pencil test, it consists of six parts: comprehension and retention, visual memory, memory for content, logical reasoning, scientific vocabulary, and understanding printed material. Hundreds of colleges having pre-medical courses give the test. It predicts well a student's success in medical school and even later as an interne.

One study, for example, showed that of the highest 10% of students on Moss's test, 93% obtained medical school grades of 80 or above. Dividing medical school freshmen into four equal groups on the basis of their test scores, it was found that in the highest quarter only 1% failed in their freshman year. In the second quarter 8% failed; in the third, 16%; and in the lowest, 31%. Indeed the test has proved so valuable that 90% of the medical schools use it, though they do not accept or reject students solely on this basis.

Aptitude for nursing somewhat resembles that for medicine. CATHARINE C. MILES found that to be a good nurse one should like people, have tact, good general intelligence, broad interests, emotional stability, patience, sound health, and resourcefulness. Moss, with Thelma Hunt, developed an aptitude test for nursing. It does not pretend to diagnose the total personality, but measures abilities required in nurses' training. It tests scientific vocabulary, general information, understanding printed material, memory, and ability to follow directions. As in the medical and other professional tests, this test deals mainly with general mental ability.

The Stanford Scientific Aptitude Test, constructed by D. L. Zyve, attempts to bring out aptitudes essential to success in scientific fields, irrespective of previous knowledge and training. It is designed to reveal experimental bent and ability to think and observe accurately. The questions deal with mathematics, choice of the best approach to common scientific problems, analysis of the motion of gears, inconsistencies in statements relating to chemistry and physics, approval or disapproval of proposed technical projects, comparison of heights and lengths of lines, procedures in several types of laboratory investigation, noting and checking the details of complex geometrical figures. Sometimes the subject is asked whether or not he likes this type of problem. This test has proved helpful, especially to students who are thinking of entering the fields of engineering, chemistry, physics, or biology.

Engineering has its own special tests. In 1922 Louis L. Thurstone devised a vocational guidance test for engineers, consisting of sections on arithmetic, algebra, geometry, physics, and technical information. From results of 6,500 high school graduates taking the test Thurstone was able to predict that students in the highest quarter had 93 chances out of 100 of passing in engineering school. Those in the second and third quarters had 89 and 81 chances respectively out of 100. Those in the lowest quarter had only 53 chances.

Many psychologists find mechanical aptitude tests useful for selecting engineers. Johnson O'Connor, of the Human Engineering Laboratory in Hoboken, N. J., devised a "Wiggly Block Test" with which he measures ability to visualize in three dimensions. It has nine pieces of wood with wavy sides. When properly fitted together they form a solid rectangular block.

O'Connor reports that of 4,000 men taking his test, 82% of the engineers scored better than the midpoint of the whole group, as did about three-quarters of the draftsmen and mechanics. While the wiggly block test's validity is sometimes ques-

tioned, apparently it measures some ability important to mechanical and engineering work.

While *aptitude tests* theoretically measure special ability apart from training, *achievement tests* measure learned performance regardless of ability. Achievement tests indicate how much knowledge or skill a person possesses in a particular field. Actually, no clear line divides the two. It is impossible for one's mechanical aptitude, as revealed in a test, not to be affected by experience and training. Likewise one's achievement in reading, algebra, or bricklaying necessarily is influenced by one's ability. Aptitude and achievement tests emphasize somewhat different things, both important in vocational guidance, employment, and personnel work. Achievement tests chiefly measure knowledge of school subjects or occupational proficiency. The occupational or trade tests include examinations for carpenters, plumbers, electricians, butchers, radio operators, etc., and performance tests for patternmakers, sheet-metal workers, lathe operators, typists and stenographers, and even streetcar motormen.

In short, aptitude tests measure rather accurately the special abilities not closely related to one's "general intelligence." They help guide students toward suitable occupations, reveal something about an applicant's fitness for a specific job, and sort out persons capable of special work or responsibility in business, industry, or the armed forces.

Aptitude tests yield no reliable information about occupational interests or about personality traits, such as honesty or persistence. Previous knowledge or experience affects them to a certain extent, but not as much as in the case of achievement tests.

Therefore tests of special aptitude should be used along with intelligence tests, interest tests, and achievement tests, plus a personal interview and personality or character ratings by teachers and former employers.

CHAPTER IV

Feeble-mindedness and Genius

SEGUIN BINET SIMON GODDARD
HOLLINGWORTH TREDGOLD PENROSE DOLL
GALTON ELLIS CATTELL FREUD ADLER
TERMAN COX HILDRETH WOODROW



How do feeble-minded persons and geniuses—occupying positions at opposite extremes on the intelligence scale—differ from normal people? What causes mental deficiency? Can it be cured? What are its main types? What is genius and what produces it? Do our greatest leaders have the highest I.Q.'s? Are geniuses maladjusted?

FEEBLEMINDEDNESS, or mental deficiency, involves marked limitation in intelligence, due to retarded development, which results in social and economic incompetence. It should not be confused with insanity, or mental disease, which is primarily emotional disorder.

Mental deficiency exists in all degrees, from actual idiocy to mere dullness. It cannot be detected from outward appearance. Only when persons are required to make commonsense judgments and to learn new things do they reveal their mental shortcomings.

HERBERT WOODROW, of the University of Illinois, describes

the case of little Abbie, an example of high-grade feeble-mindedness similar to many found in the special classes of city schools:

"Admitted to the New Jersey Training School . . . at the age of eleven, Abbie was small for her age, left-handed and awkward. She always put the *same foot* forward when going up or down stairs; she knew her letters but could not read; she could count to ten; she knew some color and form; and she sang a number of hymns that she had learned at home. Her sight and hearing were normal, and she was fond of play. Among Abbie's more unfavorable characteristics were a bad memory and a poor power of imitation. She was gluttonous, untidy, untruthful, sly and profane.

"Three months after her admission she could thread a needle and sew on buttons, could dust and rub floors a little, had learned to read *A man ran* and *I see a man* (sometimes), counted to twenty, and, with help, could do such number work as this:

$$\begin{array}{r} 1 \quad 2 \quad 3 \\ 1 \quad 1 \quad 1 \\ - \quad - \quad - \end{array}$$

"For ten years she went to school. 'For ten years', runs the report, 'her teachers struggled heroically to give her mastery of *something*. Little less than marvelous is the optimism and faithfulness of those teachers! We see them struggling on month after month, not in that perfunctory way born of discouragement or conscious failure, but with that courage and cheerfulness which comes from grasping at every straw of encouragement, of progress, of fancied improvement. Had these teachers become discouraged, we would have to admit that perhaps the result might be due to that fact. But there is no sign of giving up in all these years. Within the last few months, however, there has appeared the feeling that Abbie has reached her limit. She will be twenty-two years old before long.

"To-day she is still small for her age. She can braid cornhusks

a little; can make a bed; can iron an apron; cannot count the cost of three one-cent stamps and three two-cent stamps, with the stamps before her; cannot repeat five figures or a sentence of fifteen words; defines only in terms of use; can read a few sentences, spell a few words, and write about twenty-five words from memory; knows the days of the week, but not the months of the year; and does not know how many fingers she has on both hands.' ”

Early Studies of Mental Deficiency

Until the nineteenth century little attention was given to training the feeble-minded. Among the first to experiment on this was ÉDOUARD SEGUIN, a French doctor, who founded in 1837 a center for training idiots. Realizing he could not restore mental defectives to normal, Seguin tried to develop what capacities they had by what he called a “physiological method.” He trained subjects in motor control by having them walk along lines, climb ladders, and the like, and taught them to respond to loud noises or bright colors.

In Switzerland a young doctor named Guggenbühl studied and tried to train a type of defectives known as cretins, prevalent in that country. Beginning the “colonial” system of caring for feeble-minded, he kept them in a colony of buildings high in the mountains, avoiding the necessity of unpleasant confinement. Extreme claims about his success caused his project to fail, but his ideas were carried over into similar undertakings later.

In Berlin Dr. M. Saegert devised special training methods for feeble-mindedness among the deaf, and in 1845 founded an institution for mental defectives. This encouraged the founding of similar institutions soon afterwards.

Treatment of mental deficient in general followed Seguin’s system until the twentieth century, when intelligence tests and studies of heredity were introduced.

Binet and Simon suggested that feeble-mindedness be defined

by mental age. This idea was adopted by Terman, LETA S. HOLLINGWORTH, of Columbia University, and HENRY H. GODDARD and EDGAR A. DOLL, of the Vineland Training School. As a result of their work satisfactory appraisals of the three grades of mental deficiency—moron, imbecile, and idiot—were agreed upon.

Morons, Imbeciles, and Idiots

Goddard coined the term “moron” to specify the highest level of mental defect, ranging in I.Q. from 50 to 70. An adult moron has a mental age of 8 to 10 or 11 years. The men can learn to do many kinds of farm work, carpentry, chair-caning, janitorial work, and even mechanical jobs like operating a lathe. Women morons can learn to knit, cook, wait on tables, do fancy laundry, and operate a sewing machine. But morons have to be supervised; they are at a loss when something goes wrong. They get along best on farms or in small towns, where they are known and where allowances are made for their dullness. In large cities life is difficult for morons, and some of them drift into thievery, prostitution, and other petty crimes.

Imbeciles and idiots need institutional care. With an I.Q. of 25 to 50 the adult imbecile has a mental age equivalent to that of a child between 4 and 7 years. Most imbeciles learn to dress, wash, and feed themselves. They can do many kinds of routine work, such as washing floors, digging holes, weeding, dishwashing, simple sewing, and laundry work. Their work has to be planned for them and carefully directed. Imbeciles can talk a little, but seldom learn to read.

Idiots, the smallest of the three groups, are pretty hopeless. Having a mental age of 3 years or less, they must be treated like infants. With patience they can be taught to pick up stones, pile wood, polish flat surfaces, and such simple tasks. After long periods of training some idiots can learn to dress and undress them-

selves. But they never learn to speak and understand more than a very few words.

Idiots Savants

Once in a while mental deficiency is accompanied by singular skill in some special line. Such cases are called "idiots savants," though, as Edmund S. Conklin points out, they are imbeciles rather than idiots and they are savants only by courtesy. Their special skill is generally in the field of memory, mathematics, or mechanical ability.

Probably the most famous case of an idiot savant was the "Genius of Earlswood Asylum," described by A. F. TREDGOLD, British authority on feeble-mindedness. From 1850 to 1916 an inmate of Earlswood Asylum named Pullen astonished authorities by producing remarkable crayon drawings, carving expertly in ivory and wood, and constructing ship models so intricate and detailed that they are still displayed in the two large workrooms placed at his disposal in the asylum. His proudest accomplishment was a ten-foot model steamship that took more than three years to complete. Equipped with brass anchors, screws, pulley blocks, copper paddles, 5,585 copper rivets, and 13 complete lifeboats, it also contains nearly a million and a quarter wooden pins fixing the planks to the ribs. Pullen made these with a special instrument of his own designing. The cabins are decorated and furnished with chairs, tables, beds, and bunks.

In other abilities Pullen was notably deficient. Until the age of 7 he did not speak and then for a long time uttered only the word "muvver." He learned to wash and dress himself and eventually to write the names of simple objects, but beyond these elementary accomplishments he failed to go. Probably it is significant that he was very deaf. At the asylum he behaved well usually, if left alone to work out his projects. Once he threatened to blow up the place because a request was refused, and at another time constructed a guillotine over his door, planning to behead an unfortunate stew-

ard whom he disliked violently. A crisis arose when he fell in love and determined to marry the lady against all arguments. In an inspired moment the committee procured an elaborate gold-braided uniform. Pullen was called to the board-room, told that his request to marry would be granted, although the asylum would deeply regret losing his valuable services, but that if he would reconsider, the committee proposed, as an alternative, to make him an admiral in the navy. The uniform was then produced. Pullen succumbed. He took the uniform and never again mentioned the subject of marriage. At the age of 81 he died, having worn the uniform often on special occasions.

Tredgold notes that Pullen's observation, attention, and memory were good, but he was emotionally unstable, childish, and lacking in mental balance. A brain defect which impaired hearing early in life cut him off from his fellows and made possible his tremendous absorption in carving and drawing. How much his striking achievements were due to this intense and single-minded preoccupation with mechanical things, and how much was due to innate special abilities, it is impossible to say.

Cases with Physical Defects

Rudolf Pintner and Donald Paterson estimated in 1916 that about 3% of our population is mentally deficient. Later research confirms this estimate. Not more than 10% of the feeble-minded can be recognized as such from outward appearance, according to HARRY L. HOLLINGWORTH, of Columbia University. However, a few varieties of feeble-mindedness are accompanied by physical defects. Four readily distinguishable types are described by A. F. Tredgold and LIONEL S. PENROSE:

The *cretin* is dwarfed in stature, with short, bent legs, dry skin, coarse hair, thick lips, and a large head. Cretins have idiot or imbecile mentality. Cretinism definitely results from underactivity of the thyroid gland, and can be relieved by giving thyroid extract if treatment begins early enough.

The *mongoloid*, so called from a supposed resemblance to the Mongolian race, has narrow slanting eyes, an enlarged tongue with deep crosswise fissures, and a flattened face and skull. Mongoloids are usually imbeciles. Mongolism always is congenital, not hereditary. Some unknown influence affects the embryo about the eighth week of pregnancy or earlier. Researchers agree that it is somewhat commoner in children whose mothers have already borne large families, but they doubt that this is the main cause of mongolism.

The *microcephalic* is characterized by an extremely small skull, with receding forehead. Usually microcephalics have imbecile mentality, though they range through every degree of feeble-mindedness. Probably microcephaly results from damage to the fetus during gestation, caused by a diseased condition of the mother or fetal injury from mistreatment of the mother during pregnancy.

The *hydrocephalic* has an abnormally large skull, with high protruding forehead, due to excessive fluid between his skull and brain or within the brain. Variations in mentality range from idiot to normal. Medical treatment seldom remedies the condition.

Birth injuries which destroy cerebral tissue cause 5% to 10% of feeble-minded cases, according to Edgar A. Doll and two research associates. The frequency of birth injury usually is not realized because early physical symptoms tend to clear up and be forgotten. When cerebral injury occurs but does not affect a child's motor responses, the resulting mental deficiency often is mistaken for congenital feeble-mindedness. Birth injury cases tend to improve with special training, maturity, and better physical condition.

If syphilis infects a child before birth, which means that the disease comes direct from the mother, syphilis organisms may attack the child's brain and cause feeble-mindedness. Tredgold describes typical symptoms of congenital syphilis. At birth the

infant usually appears normal, though slightly underweight and anemic. Other symptoms seldom appear before a year, when suddenly a leg or arm becomes paralyzed, or one eye rolls outward. Convulsions may follow, paralysis increases, and mental retardation is evident. The disease can be arrested by raising the patient's body temperature with malarial fever, hot pads, or electric currents passed through the body. Destroyed cerebral tissue can not be restored, but further destruction is prevented and the patient may continue life at this lower mental level.

Seventy per cent of epidemic encephalitis, or "sleeping sickness," cases impair the victims' mentality or bring about loss of emotional control. Tredgold describes a young patient who took offense at some innocent remark, jumped up, swore, hurled a flower pot through the window, and violently kicked the physician's shins. While the intellectual deterioration resulting from encephalitis is less severe than some other types, treatment and reeducation of these persons have not been very successful.

Other causes of feeble-mindedness include epilepsy, some endocrine disorders, malnutrition either before or shortly after birth, and sensory defects such as partial deafness or blindness which retard the learning process.

Treatment and Education

For the majority of feeble-minded cases no clear-cut organic basis is known. Presumably the condition results from imperfect structure and function of the central nervous system. "Insufficiency of brain cells" is the way one authority summed it up. In by far the greatest number of cases medical treatment is ineffective. The best that can be done is to fit mentally retarded persons into the social order as well as possible.

Mentally retarded persons are by no means hopeless, as was shown by Warren R. Baller, clinical and educational psychologist. He made a study of 200 persons who had, in elementary school many years before, I.Q.'s of less than 70. Though these

persons completed, on the average, only four and one-half grades of school, 83% of them were wholly or partially self-supporting in their adult years. Baller concluded that mental deficiency does not make impossible a life of social usefulness.

For dull pupils special classes exist in the larger public school systems. Here extra drill is given; if they can not be brought up to their grade they are taught that part of the curriculum they can grasp and are given vocational and industrial training. Experiments are constantly being tried out to discover the kind of training programs and working situations which will best fit mental defectives into our social and economic system.

Pioneer Studies of Genius

Genius commonly is thought of as outstanding achievement. Psychologists have stressed that it also involves outstanding ability. LEWIS TERMAN spoke of the brightest 1% of children—those above I.Q. 140—as possessing “genius.” Leta S. Hollingworth, also interested in superior ability, preferred the terms “gifted child” or “exceptional child.” She considered a child with an I.Q. of 180 or better a potential genius, with one or two chances in ten of making a contribution which would justify the use of the word “genius.”

Most psychologists agree that genius combines superlative ability with remarkable achievement in certain fields. Anne Anastasi, in her book *Differential Psychology*, notes that we speak of genius only in science or the arts, not in, say, roller skating or cooking. In cultures having different standards a cook might well be called a genius, but not in ours.

Genius includes only the topmost small fraction of 1% of our population in terms of both ability and achievement. A genius is not a special kind of person in a class apart, but is merely a human being who excels others in performance—who excels most persons by a great deal, but others, the near-geniuses, by only a little. It is entirely a matter of degree. Geniuses are few;

somewhat more near-geniuses exist, and the numbers grow as one passes down the scale from very superior to superior to ordinary persons.

FRANCIS GALTON, a cousin of Charles Darwin, published the first systematic study of genius in 1869. Making eminence his criterion for genius, he concluded that genius is hereditary. Shortly afterwards a Swiss writer named de Candolle disagreed with Galton, listing numerous environmental conditions that help to produce scientific genius.

The English philosopher scientist, HAVELOCK ELLIS, after investigating the backgrounds of prominent persons, reported in 1904 that the eminent come chiefly from professional families. Less than 2% of his group of over 1,000 had either insane parents or insane offspring. Ellis also found that his eminent persons often were eldest children, born when their parents were on the average 37 years old. Noting that more males than females were found among geniuses, Ellis proposed that males tend to extremes more than females. Leta Stetter Hollingworth disagreed, pointing out that society never gave women an opportunity to manifest their genius.

JAMES McKEEN CATTELL studied the backgrounds and birth-places of outstanding American scientists. He found that more than half came from the most favorably situated 1% of the population. The son of a successful professional man, said Cattell, is fifty times as likely to become a leading scientist as an ordinary boy. Cattell also found that the cities, and the states with good educational systems, contributed a disproportionately large share of eminent scientists. These data suggest that environmental factors are important in fostering genius.

SIGMUND FREUD, founder of the school of psychoanalysis, was interested in the personality factors producing genius and talent. Believing that the libido, or sex drive, is man's strongest motive, he regarded the contributions of genius as substitute activities resulting from a frustrated sex urge. ALFRED ADLER, an early col-

laborator of Freud, best known for originating the term "inferiority complex," considered the achievements of genius to be over-compensation for inferiority feelings.

Other writers assert that genius is akin to insanity. This theory was advanced by the Italian criminologist Cesare Lombroso, and popularized by the German Max Nordau fifty years ago. Though psychological research justifies no such conclusion, the idea persists that insanity and instability, if not actual degeneracy, accompany genius. Recent books on genius by Ernst Kretschmer and by Wilhelm Lange-Eichbaum cite many instances of the close connection between genius and insanity, but most psychologists are doubtful. Perhaps Byron, Napoleon, Wagner, and Dostoevsky did have psychopathic tendencies, but what of Shakespeare, Bach, Darwin, and Einstein? Selecting and stressing a few cases never proves a general statement.

The I.Q.'s of Famous Men

Catharine Cox, later Mrs. W. R. Miles, an associate of Terman, has studied carefully the biographies of 300 eminent persons born between 1450 and 1850. From her data three psychologists estimated that the I.Q.'s of these famous men and women ranged from 100 to 200, the average falling between 155 and 165. John Stuart Mill, Goethe, Macaulay, Pascal, Leibnitz, and Grotius were assigned I.Q.'s of more than 180. Previously Terman had placed Galton's I.Q. at close to 200.

Amazing early accomplishments of these men are reported. John Stuart Mill learned Greek from his father at the age of three. Before he was eight he had read many Greek classics, also English historians like Hume and Gibbon. Between eight and twelve he added Latin and mathematics, including algebra, geometry, and calculus. He started to write a history of Roman government, and became interested in science. Logic and political economy came next. Mill admitted reading some lighter books, like *Robinson Crusoe*, but usually his father kept him on

sterner fare. In his autobiography Mill expresses doubts as to the wisdom of this kind of education. But the fact remains that his very superior ability plus a rigorous intellectual training produced one of Britain's greatest logicians and political economists.

Francis Galton learned to read at the age of two and a half, to sign his name at three, and to write a letter before he was four. At five he could recite long passages from Scott's *Marmion*. The day before his fifth birthday he wrote the following letter to his sister Adele, who had directed much of his training:

"My dear Adele, I am 4 years old and can read any English book. I can say all the Latin substantives and adjectives and active verbs besides 52 lines of Latin poetry. I can cast up any sum in addition and multiply by 2, 3, 4, 5, 6, 7, 8, 10. I can also say the pence table. I can read French a little and I know the clock.

Francis Galton

February (sic) 15, 1827."

Abraham Lincoln, on the other hand, is assigned only a moderately high I.Q. (125-140) in Mrs. Miles' genius study. Lincoln's mother took an active interest in his education because he seemed promising, though slower to comprehend than other boys. In childhood he was extraordinarily studious, and had an "investigating mind" that dug relentlessly into facts and ideas. Once learned, a fact was not forgotten. His power of concentration was intense. He studied long and hard, often at night by a log fire, as every school child has heard, and stood at the head of his class in grammar school. He became champion speller of the district and also something of an authority on astronomy. Farm work he did with equal thoroughness, though in every free moment he was inclined to pull a book out of his pocket and read. At 17 he dabbled in verse writing, a not unusual pastime for young men of that age, wrote essays on American government and on temperance, which won local praise, and continued to read everything

available in print, from the Bible to a Louisville newspaper. In these early intellectual prowlings was laid the foundation of Lincoln's later career. Unlike many prodigies, he was a bootstrap genius who rose above his surroundings by independent effort and indefatigable study.

Benjamin Franklin's rise to fame shows certain similarities. In and out of school during early childhood, he read constantly anything and everything he could lay hands on, while learning the soap-making trade and serving as apprentice to a cutler. When his father recognized Franklin's ability as a scholar, the boy was sent regularly to school, where he leaped to the head of the class and promptly skipped a grade. Arithmetic he flunked. Later, ashamed of his record in mathematics, he determined to master the subject, sped through an arithmetic text and two books on navigation, including their geometry. Like Lincoln, he excelled in intellectual argument and in physical feats. Where Lincoln split rails to the admiration of the countryside, Franklin won considerable acclaim as a swimming teacher. In the printing trade Franklin showed his inventiveness by making both type and ink, but for a time his talent turned chiefly toward writing. He became best known as a diplomat, statesman, and scientist. In Mrs. Miles' genius study his I.Q. is rated at 145.

Napoleon Bonaparte is given an I.Q. between 135 and 140. When very young he showed a passion for military things. Above all he liked playing with tin soldiers. He organized snow fights, led the village boys in raids against the shepherd boys, and later, in a Paris military school, spent his free hours studying military tactics and planning elaborate battles. To subdue his tempestuous nature, his mother first sent him to a girls' school. His first love affair is said to have occurred at the age of five. At later schools he showed unusual interest in mathematics, history, and the exact sciences. Repetition irked him. He never learned to spell correctly, wrote a deplorable hand, and limped along in languages. A professor of literature once described his flair for

rhetoric as "granite heated by a volcano"—the rhetoric flowed mostly in patriotic torrents, eulogizing his native Corsica or military heroes. He was not slated for genius by his family, who looked at his misshapen head and foresaw no brilliant future. But the haughty, obstinate, egotistical schoolboy realized his ambitions. Over a century after his death his name remains synonymous with military genius.

The intelligence of these geniuses, though high, is not always remarkable. (I.Q.'s of 140 to 160 are not uncommon among college students and professional persons.) Mrs. Miles notes also that the eminent persons she studied had many favorable personality traits like persistence, self-confidence, and great strength of character. In addition, she generally finds other advantages aiding their development, such as eminent relatives, cultured homes, and good schooling. Three factors—natural ability, personality traits, and environment—according to this investigation, combine to produce genius.

Child Prodigies

Present-day prodigies also have been studied and followed over a period of years. Leta S. Hollingworth, for example, reported on a youngster with an I.Q. of 187 who graduated from high school just before his twelfth birthday. He completed college in three years, and was elected to Phi Beta Kappa at the age of 14 years and 9 months. Entering graduate school he obtained his Ph. D. degree at 18. Like many talented and gifted New York City children studied by Mrs. Hollingworth, he was somewhat healthier and better adjusted than the average child.

Another precocious child, a little girl described by L. M. Stedman, obtained an I.Q. of 214, probably the highest on record. This child spoke meaningful words when only 7 or 8 months old, and walked at 10 months. At 3 years her parents found she knew the alphabet, which she had learned by asking questions about printed signs. When $4\frac{1}{2}$ she was permitted to sit in the first grade

because her chum was there. In a few months she could read easily, so she was put in the second grade. At the end of the next year, when 5 years 9 months old, she was promoted to the fourth grade. She was an untiring reader; at 9 her favorite authors included Barrie, Dickens, Victor Hugo, and George Eliot. Her parents were professional people, and both they and the grandparents were of superior mentality.

GERTRUDE HILDRETH, psychologist at the experimental Lincoln School of Teachers College, Columbia University, compared children having I.Q.'s over 130 with children having I.Q.'s around 100. In the superior group she found these traits: perseverance in the face of difficulty, alertness, interest in problems, great mental energy, good humor, sustained attention, and mature use of language. The gifted children also comprehended and responded more quickly than the normal group.

Terman, with several associates, surveyed more than 600 cases of California children whose I.Q.'s were 140 or more. Comparing these children with others of average ability they made several important discoveries. The gifted children came from socially and culturally superior homes. They had many eminent relatives and ancestors, and their parents were well educated. Incidence of insanity was much lower than the average. The health and growth rate of gifted children was superior, as was their personality and character development. Follow-up studies made seven years later revealed very little decrease in I.Q.'s; the gifted group still ranked far above average in scholarship, health, leadership, and personality adjustment.

In 1940, eighteen years after the first investigation, Terman made a second check-up to see how well these gifted children were succeeding in life. He found the death, insanity, suicide, and divorce rates for the group lower than average. Ninety per cent entered college, and of these 93% graduated; their scholarship and activity records considerably outranked those of average students. At age 30 the average income was \$250 a month.

Clearly, very superior ability is associated, biologically and environmentally, with superior family background. High mental ability tends to remain high. Those having it, contrary to popular belief, also show better than average health, physical strength, personal and social adjustment.

CHAPTER V

Effect of Heredity and Environment on the Individual

MENDEL GALTON DE CANDOLLE GODDARD
ITARD KELLOGG THORNDIKE BLATZ
NEWMAN FREEMAN HOLZINGER BURKS WELLMAN
PINTNER WATSON GOODENOUGH HEALY



What is meant by heredity and by environment? How are they related? Why are they important to psychology? Is it possible to study the effects of one independently of the other? Why is it meaningless to ask: "Which is more important, heredity or environment?" What types of human behavior are chiefly determined by heredity? What by environment?

EACH OF US enters the world with a certain heredity, the characteristics transmitted to us through our parents' germ plasm, itself the product of a long line of ancestors. We grow up in certain environments, our material and social surroundings. Everything we do, as a child or adult, in the last analysis results from the complex interacting of our heredity and our environment. To understand and control human behavior we must know something about the nature and function of each.

In 1900 an astonishing discovery was made almost simultaneously by three biologists working independently on problems of heredity. The discovery did not result from their own experimenting, but from that of an Austrian monk named GREGOR MENDEL, whose work they found in an obscure scientific journal which had been published 34 years earlier and promptly forgotten. Mendel had puttered in his garden, crossbreeding peas. When he mated white-flowered peas with red-flowered peas he found that certain intangible factors, which he called merely "elements" for want of a better term, determined whether the offspring would be red or white. The "elements" produced consistent ratios between red and white offspring, not only for one generation, but in successive generations. These rules for hereditary transmission became known as Mendel's laws.

At once biologists the world over followed up Mendel's study. In America Thomas Hunt Morgan and Raymond Pearl, among others, developed the theory of heredity according to *genes* and *chromosomes*, terms that replaced Mendel's "elements." Genes, so far as can be determined, are submicroscopic protein molecules existing in germ cells. Linked together in definite patterns, the genes form chromosomes. These complicated patterns of genes, unique for each person, determine his heredity. A human germ cell contains 24 pairs of chromosomes, each made up of probably thousands of genes. When a male sperm and a female ovum unite at the time of conception, each releases one of each of its chromosome pairs, which then combine in the cell nucleus of the new individual formed and thus determine his whole physical heritage.

What traits do we inherit? We inherit the color of our eyes, hair, and skin, shape of skull, and a tendency to be short or to be tall. Certain physical defects like color-blindness, stub fingers, and some forms of baldness also are inherited. No common diseases except diabetes are hereditary, though inherited predispositions toward cancer, tuberculosis, and allergies may exist. Only two

mental abnormalities definitely are inherited—feeble-mindedness, and Huntington's chorea, a rare malady characterized by physical and mental disintegration. Authorities disagree about the role of heredity in several other mental diseases. The degree of intelligence we possess is inherited, according to the great majority of psychologists.

In one brief instant at the moment of conception when genes from the father and mother unite, heredity is determined. Whatever else shapes an individual is environment. As embryo and fetus he develops in a uterine environment; then after birth in a complex physical and social setting. Among other influences, he is affected by food, climate, geographical location, kind of home and neighborhood, school, community, and nation. This environment determines what a person sees, hears, touches, smells, and tastes. It can speed up or retard growth and development. It provides what one learns and remembers; it furnishes the stimuli to which one reacts emotionally. Other human beings, who influence and in turn are influenced by the individual, are a significant aspect of environment.

During every living moment every person is the product of his heredity and environment. Always the two forces interact. Psychologically speaking, the one can not exist without the other. To ask "Which is more important, heredity or environment?" is like asking "Which is more essential to running a car, the motor or the gasoline?" Obviously both are essential.

This interdependence of heredity and environment presents a difficult problem to the scientist. He can not, by studying a person directly, learn whether heredity or whether environment mainly determines his hair color, his I.Q., or his disposition. However, he can measure the mental or physical characteristics of two individuals and note the differences between them. By carefully studying their backgrounds and experiences he can tell whether heredity or environment is the more powerful determiner of these *differences*.

Traits which heredity largely determines can be changed very little in this generation, though possibly in future generations they can be modified by a program of eugenics, through sterilization or selective breeding. Traits determined by environment can be changed by educational, social, and political improvements like better schools, more playgrounds, slum clearance, or higher standards of living.

For over seventy years, and especially since 1920, psychologists have been working on this problem of separating the strands of heredity and environment. The earliest research efforts consisted of tracing genealogies.

Family Trees

A book called *Hereditary Genius* was published in 1869 by FRANCIS GALTON, a brilliant free-lance British scientist who helped launch psychology on its scientific career. Besides studying heredity and founding the eugenics movement, he devised many mental and physical tests and statistical methods for interpreting differences between individuals.

Galton believed genius is inherited and undertook to prove it. He selected names of nearly a thousand of the most eminent statesmen, military and naval leaders, and professional persons, who had lived in the British Isles during the preceding several generations. To see whether they had more distinguished relatives than would be expected by chance, he studied their genealogies carefully. For comparative purposes he calculated that among all the relatives of any thousand unselected garden-variety Britishers, one would expect to find only four eminent persons. In the family trees of his selected thousand, however, he found well over 500 distinguished relatives. Galton believed these results proved that genius is inherited.

Encouraged by his findings in the study of genius he began research into heredity and art. This showed that of the children in 30 families of artistic parents, 64% were artistic, whereas only

21% of the children in 150 families of non-artistic parents revealed artistic ability. Children resemble their parents, Galton concluded; heredity's influence far outweighs that of environment.

This conclusion would dishearten the obscure thousands who aspire to fame had not later psychologists pointed out that Galton overlooked, or possibly in his enthusiasm ignored, several important items. In the first place, to identify eminence with genius is fallacious. Eminence implies achievement and social recognition. Some persons attain eminence at least partially through political favor, good name, or just plain luck. Genius connotes exceptional talent, which shows itself in creative achievement. Eminence and genius are related, but scientifically can not be considered synonymous. Secondly, Galton judged eminence by his own personal standards. Probably he chose well, but any one person almost certainly shows bias, if only in betraying preference for certain professions.

The most significant oversight, however, lay in Galton's slighting the role of environment. He attached little importance to the various non-hereditary factors influencing the lives of his eminent men. Indeed, this oversight was noted by A. DE CANDOLLE, a Swiss, who published in 1873 a reply to Galton's *Hereditary Genius*. De Candolle, studying genius in the field of science, compiled a list of environmental influences affecting over 500 eminent European scientists. Among the influences which foster scientific creativeness he found wealth, leisure, scientific traditions, good education, available libraries and laboratories, freedom to express opinion and follow a chosen profession, and geographical location in the temperate zone. From his evidence De Candolle concluded that environment is the chief factor producing scientific genius—an unwarranted deduction because he overlooked the heredity influences making one man brilliant, another average, and another dull, all in the same environment. While Galton was aware of favorable environmental

factors affecting his eminent persons, he wrote them off as unimportant in connection with genius.

To point out Galton's errors in the light of newer scientific findings is not to discount his great contribution in stimulating research on heredity. Nor does criticism of his work deny that ability runs in families. Recent and more careful studies show that heredity plays a major role in determining degree of intelligence, which is related to genius.

The fabulous history of the Kallikak family, traced by HENRY H. GODDARD and published in 1912 when he was director of research at the Vineland Training School for feeble-minded, often is cited to illustrate the far-reaching effects of defective heredity. Goddard noticed that several derelicts in the community (including one inmate of the Training School) bore the same surname as a well known and respected family. Tracing the genealogy he found that both groups stemmed from a common ancestor, a soldier in the Revolutionary War. In order not to reveal the family name, Goddard called this man Martin Kallikak. (The word "Kallikak" in Greek means "good-bad.") The records showed that Martin had had an affair with a feeble-minded girl, which resulted in a mentally deficient illegitimate son. From this son (known as "Old Horror") 480 descendants were traced. Of them 143 were feeble-minded and only 46 known to have normal mentality. The rest were of doubtful intelligence. The clan included 24 confirmed alcoholics, 3 epileptics, 3 criminals, 35 sexually immoral persons mostly prostitutes, and 8 brothel keepers.

After the war Martin settled down to marriage with a woman of normal intelligence and of solid Quaker parentage. In striking contrast to the other strain, all but three of the 496 descendants traced from this legitimate union were mentally and morally fit. This branch of the family included only respectable and prominent citizens—doctors, lawyers, judges, business men. Several New Jersey towns, Goddard tells us, are named for families into which these people married. No traces of feeble-mindedness were

found, no illegitimacy, no epilepsy, no crime, and only one case of bad morals and two of alcoholism were found among all the descendants. Goddard concluded that Kallikak degeneracy resulted from defective mentality caused by infusion of "bad blood."

As with Galton, however, the conclusion can be questioned. One possible error centers around the paternity of Martin Kallikak, junior. His subnormal mother firmly fixed the paternity on Martin, senior, but the evidence rests on her questionable testimony. Without proof the case loses much of its force.

Goddard, moreover, minimizes the effects of environment. Although he says that criminals are made rather than born, he does not consider the ill effects of poverty, filth, and deplorable home conditions on children born into the bad side of the family. Nor does he comment on effects of favorable influences such as the educational, cultural, and financial advantages enjoyed by the good side. That both branches lived in the same geographical locale in no way implies that their actual environments were the same.

In short, while *The Kallikak Family* indicates the inheritance of feeble-mindedness through six generations, it fails to prove that pauperism, drunkenness, and delinquency result primarily from bad family stock.

Jungle or "Feral" Children

Dramatic stories of infants abandoned in the wilds and reared by animals show strikingly environment's influence, which the genealogical studies neglected. Though such cases are rare and their data incomplete, they deserve mention.

In 1799 some hunters discovered a wild boy roaming the forests of Aveyron in southern France. He appeared about 11 years old and grubbed his living from roots and acorns, animal fashion. Captured and brought to Paris, he was put in the care of a Dr. JEAN ITARD who undertook to civilize him. The task seemed

hopeless. The boy seemed feeble-minded. He was shaken with spasms and convulsions. His senses were dull. He uttered only occasional grunts and showed no social behavior or powers of attention or observation. In Itard's own words, "his whole life was a completely animal existence."

For five years the doctor tried to train him. The boy progressed but never became normal. His sense of discrimination improved. He learned to respond to his name "Victor," and to speak, read, and recall a few simple words. His highest achievement was to learn the meaning of *lait* (milk) and to arrange the word's letters in proper order. Toward Itard and the others who cared for him he developed strong affection, but he did not learn to play or behave like a normal youngster.

This case has two conflicting interpretations. One calls the wild boy a mental defective, probably an imbecile, suggesting that he was abandoned for this reason and explaining thus his lack of progress. The other attributes the boy's apparent defectiveness to his early non-human environment, an experience affecting him so profoundly that later training brought few results. Though he progressed somewhat he could not attain normality because his most impressionable years were grossly abnormal. The fact that he coped successfully enough with a wild environment to survive for a time is pointed out as evidence that he was not mentally defective.

Each view may be partially correct. Perhaps the boy began life with low mentality; both heredity and environment may well have produced the backward child on whom Doctor Itard spent so many patient months. One can not interpret Victor's case accurately from the sketchy data recorded.

The amazing story of India's wolf children was first told by Paul C. Squires and was documented recently in a book by the anthropologist Robert M. Zingg. In 1920 two little girls, later named Kamala and Amala, were found living with wolves in the Bengal province of India. The older child, Kamala, seemed

about 9 and her sister about 2 years of age. Placed in a nearby orphanage, they were trained by the director, Reverend J. A. L. Singh, and his wife. At first the children behaved like animals. They moved about on all fours, standing upright only occasionally. Their senses of hearing and smell were acute, and Kamala apparently saw better by night than by day. A picture of her taken soon after she entered the orphanage shows her lapping up food from a pan on the ground, like a dog or a cat. She ate ravenously, particularly meat, which she stole without compunction, and growled when approached while eating. Almost two years after her capture she found a dead chicken in the yard, seized it in her jaws, ran on hands and feet to the bushes and emerged some minutes later with bloody telltale feathers clinging to her lips. She was also found devouring the entrails of a fowl.

Amala died after a short time, but Kamala lived nine years. She learned to wear clothes, eat from a plate using both hands, and walk upright, although she descended to all fours when running. Gradually her animal ways were abandoned. Instead of baring her teeth at other youngsters, she took part in their activities and moped if not included. At night she slept on a bed beside her playmates instead of roaming the fields as before. She ran errands, cared for children, used about 100 words, and showed responsibility, initiative, and self-reliance. In short, she developed an essentially human mode of life.

Unfortunately psychologists were not called to examine and train the wolf children. A journal kept by Rev. and Mrs. Singh records the only data we have of their progress. Though not scientific, it is extensive and includes 22 photographs; it is reproduced in full in Zingg's book, *Wolf-children and Feral Man*.

The most recently reported feral child is Tamasha, the wild boy of Salvador, who was captured by police after a struggle and put in the care of a psychologist named Jorge Ramirez Chulo. Tamasha, named for the one word, meaning "village," that he could speak when found, apparently was lost or aban-

doned when very young and lived with animals in the jungle. He could throw stones with astonishing precision and swing skillfully from limb to limb of the jungle trees. At first he refused cooked foods, lapped up liquids from a dish, and preferred curling up on the floor to sleeping in a bed. Under Chulo's supervision he progressed rapidly. With good grace he accepted clothes, baths, and barber shops. He acquired a considerable vocabulary and described eating with animals in the jungle, but he could not recall human parents.

What, if any, conclusions can be drawn from these cases of feral children? Information on many important points is too scant; for example, an exact account of behavior when first discovered, precise data about training, or degree of success in learning. From the evidence on record one can say merely this: It is possible, though uncommon, for human children to survive in a non-human (animal) environment. Such children develop some means of locomotion, speech sounds of a sort, emotional reactions, and various habit patterns adapted to their environment. On the other hand, many kinds of usual human behavior are absent—chiefly reasoning, language, and social conduct. Feral children can be re-trained, but the longer they have been isolated from human influences the harder it is to teach them and the less likely they are to become normal. For a child to develop a human personality, he must have the usual social contacts. Environment is shown to play a vital part in the process.

The Ape and the Child

Children can not be thrust arbitrarily into a non-human environment for experimental purposes. The opposite is quite possible, however; an animal can be reared in a human environment to see how far it can be humanized within the limitations of its structure or heredity. The story of how an ape and a child

were brought up together reveals the astonishing capacity for human achievement shown by a young chimpanzee.

Professor and Mrs. WINTHROP N. KELLOGG, psychologists at the University of Indiana, brought into their home a seven-and-a-half-months-old ape to be reared for about a year with their ten-months-old son, Donald. Like the boy, the ape, Gua, was dressed in diapers, rompers, shoes, and stockings. She was given a crib, high chair, cup and spoon of her own. She was bathed and fondled, just as the child was, by her foster parents. After a few weeks Gua and Donald became friends. The ape, more demonstratively affectionate than Donald, kissed the boy, held his hand, and assumed a protective attitude toward him. When he was given attention she showed obvious jealousy. They learned to play ball and other games together, like two children.

Gua learned to walk in an upright position, to shake hands, drink from a glass and eat with a spoon, to unlatch a door, and scribble with a pencil. In learning to switch on a light she out-did Donald. Although Gua failed to learn "pat-a-cake" she was more apt than Donald in solving problems such as moving a chair into position to reach a cookie hung from the ceiling. In mental growth ape and boy showed equal progress as measured by the Gesell tests for pre-school children, consisting of standardized norms by which to judge development.

The most striking differences between the two lay in the realm of language. Human articulation Gua never mastered, whereas Donald progressed normally through "ma-ma," "da-da," and the usual infant sounds. On the other hand, in responding to spoken words, Gua at first surpassed Donald. At about 16½ months she responded properly to fifty-eight phrases, like "don't do that," "hug Donald," "show me your nose," "blow the horn." In comparison the child responded to sixty-eight phrases, though it must be remembered he was nearly 3 months older.

Contrasts between ape and child are somewhat hard to make because their rates of physical and mental development differ.

In general the ape progressed faster at first and reached her best performance sooner. The child developed more slowly but attained a higher level. However, the experiment did not continue long enough to determine whether or not the ape had reached her maximum capacity in all respects.

Although strikingly unusual environments can alter greatly the behavior of human beings and animals, environment exerts its effect only to the point where hereditary structures impose limitations. Tamasha learned to swing from branch to branch of jungle trees, but never as well as monkeys because his body was unadapted to living in trees. Gua learned the meaning of certain words, but could not speak human language because her vocal equipment and nervous system were inadequate. She never achieved great manual dexterity because her hand was poorly constructed for intricate adjustments. Heredity sets limits that can not be transcended. Within these limits, however, widely varied behavior is possible. The detailed behavior pattern results from experience and training—that is, from environment.

Studies of Twins

How can psychologists disentangle the strands of heredity and environment in studying human beings? One good way is to compare persons having the same heredity (identical twins) but different environments. If the twins have been separated at birth or shortly after, and reared in different surroundings, the differences appearing in their physical and mental traits can be assumed to result from environment, since their heredities are identical. Another way is to compare persons having different heredities but the same environment, such as a foster child reared by parents with their own child of the same age, the two being treated just alike. Differences found here may be attributed to heredity since environment remains constant. Naturally such cases are hard to find, but approximate situations yield fairly conclusive results.

Twins may be *identical* or they may be *fraternal*. Identical twins stem from one ovum and are of the same sex and genetic constitution. Their eyes are alike, also their hair color, facial features, head shape, fingerprints, and—according to recent research—even their brain waves. The twins we can not tell apart generally are identicals. Fraternal twins, on the other hand, come from different ova and spermatozoa, though conceived and born at the same time. Their physical traits and genetic makeup are similar, but no more so than “siblings,” the term applied to non-twin children of the same parents. Fraternal twins may be of the same or opposite sexes. For psychological studies identical twins are more useful, though often it is important to use fraternal twins for comparative purposes.

The indefatigable Galton, discussed in connection with heredity and genius, was the first to realize that twins could be valuable to science. He assembled information, mostly in the form of anecdotes, about eighty pairs of twins, both identical and fraternal. His data indicated amazing similarities between identical twins even when they were reared apart. On the contrary, twins dissimilar at birth, though brought up together and treated alike, differed widely in their behavior. Galton's conclusions again stressed the overwhelming importance of heredity. Unfortunately the accuracy of the data he secured was not checked, so the study hardly can be called scientific. For example, Galton includes a statement from a mother of twins in which she speaks of “an interchangeable likeness of expression that often gave to each the effect of being more like his brother than himself!”

The first really experimental twin study was made in 1905 by EDWARD L. THORNDIKE, of Columbia University. Thorndike, a pioneer experimental psychologist, contributed to practically every branch of the science and became famous for his work in learning and intelligence testing. Interested in heredity's effects on human ability, he gave fifty pairs of twins six mental tests

which involved problems in addition, naming opposites of given words, canceling all "a's" on a printed page, and the like. With the same material he tested pairs of siblings, i.e., ordinary non-twin brothers and sisters. A striking similarity showed up between the test scores of the twin pairs as compared to scores of the sibling pairs. Twin scores were two or three times more similar than were sibling scores. This suggested that heredity dominated in determining the abilities tested, since the environments of twins and siblings were the same.

More recent studies, such as one by A. H. Wingfield, have used all three types—identical twins, fraternal twins, and siblings. Mainly tests of intelligence have been given, but physical traits and motor abilities (steadiness, rate of tapping, etc.) have been checked in some cases, as, for example, by Karl J. Holzinger and Quinn McNemar. The results are clear-cut. Identical twins resemble each other so markedly that by knowing how one performs on various tests we can predict quite accurately the other's performance. Fraternal twins resemble each other less, but more than do siblings. Apparently, then, heredity largely determines intelligence and motor performance as well as physique.

The question often arises: why are not measurements and scores of identical twins *exactly* alike? Their slight differences may trace back to minute differences in heredity; we never can be sure that twins' genetic patterns are identical in every detail. Or, as JOHN B. WATSON, the behaviorist, points out, the cause may be differences in environment which can occur even when identical twins grow up in the same home and are treated alike.

The last point is important. Even identical twins are separated at times, if only to visit the dentist or recover in isolation from mumps. One breaks a leg and the other goes to school alone. In some cases they make different friends. At home they work out a division of labor; one dusts and the other wipes dishes. One comes to act as spokesman for both in talking with strangers. This different behavior is even more marked with triplets.

Interesting differences in the Dionne quintuplets' behavior are reported by WILLIAM E. BLATZ, a Canadian psychologist. Yvonne is serene, self-confident, and liked best by her sisters. Annette assumes social leadership. Emilie seems most self-sufficient. Cécile is capricious and unpredictable. Little Marie, who had physical handicaps and seems the baby of the group, appears least popular with the others and makes most demands upon nurses. Genetically the "quints" are identical, though slight physical differences between them appeared at birth. According to Blatz, environment has produced these personality and behavior differences. Each quint plays a unique role in relation to the others, and has a certain status in the group. Probably differences will increase rather than lessen.

Identical Twins Reared Apart

To test the effect of different environments upon persons of the same heredity, three University of Chicago professors, HORATIO H. NEWMAN, FRANK N. FREEMAN, and KARL J. HOLZINGER, scoured the country for cases of identical twins who had been raised apart. Finally they located nineteen pairs who had been separated when very young and adopted by different families. Their physical measurements were taken and they were given mental tests. The resulting average differences between these twins, compared to differences between identicals reared together, are shown in the following table*:

	DIFFERENCES BETWEEN IDENTICAL TWINS,	
	REARED TOGETHER:	REARED APART:
Stature	1.7 cm.	1.8 cm.
Weight	4.1 lbs.	9.9 lbs.
I.Q. (2 tests)	5 or 6 points	8 or 9 points

A change in environment seems to affect stature very little, though, as might be expected, it can cause variations in weight. The effect on intelligence shown in the table is further borne

*Adapted from *Twins*, by Newman, Freeman, and Holzinger.

out by dividing the 19 cases into those pairs where both were placed in similar homes (such as families of professional men) and those pairs where the twins went to dissimilar homes. It was then found that twins in the first group, like twins reared together, differed from each other in intelligence by only 5 or 6 points, whereas in the latter group the difference was 10 or 11 points. The greater the environmental difference, the greater the intelligence difference, though the amounts are small.

Education appeared to be the most important single factor affecting intelligence. One girl, for example, grew up in a good farming section and attended college; her I.Q. was 116. Her twin sister, who lived in a backwoods community and went to school only two or three years, revealed an I.Q. of 92. This was the greatest I.Q. difference found in the study.

Studies of Foster Children

A question that doubtless enters the mind of many a foster parent captured the interest of BARBARA S. BURKS, a psychologist at Stanford University. The question was this: does the intelligence of adopted children tend to resemble that of the foster parents, or does it carry over as a heritage from the true parents? She took 214 cases of children placed in good homes at an average age of 3 months and compared them with 105 children living with their own parents. Results of intelligence tests given when the youngsters were 5 to 11 years old showed that adopted children only slightly resemble their foster parents. On the other hand, children reared in their own homes showed noticeable similarity to their parents.* A child's heredity, then, affects his intelligence more than does the home in which he

*Correlation coefficients were .25 and .50 respectively. Correlation means the degree of relationship between two variables. A correlation coefficient having a value between .70 and 1.00 in this case would mean that the intelligence of any child agreed quite closely with that of his parents. A correlation between .40 and .60 means a moderate degree of relationship, while one of .30 or less indicates little or no relationship.

lives. From her findings Dr. Burks ventured to conclude that heredity is four or five times as important as environment in determining how individuals differ on intelligence tests.

Another aspect of the same problem concerned Freeman and two associates at the University of Chicago: how much can a foster home change the intelligence of an adopted child? He found that children given tests both before and after adoption showed an average increase of 7.5 I.Q. points after four years in a foster home. The youngsters placed in better homes gained about 10 points. Freeman tested also the intelligence of separated siblings who had lived in different foster homes more than five years. The separated brothers and sisters resembled each other far less than brothers and sisters who grew up together.* Again it was found that where environments differed widely a greater gap between the I.Q.'s appeared. To complete the picture, unrelated children living in the same home were shown to resemble each other in I.Q. somewhat more than related children in different homes.

Dr. Burks shows that heredity more than environment causes differences between children's I.Q.'s. Freeman demonstrates that a good foster home can raise a child's I.Q. appreciably. These findings differ in their emphasis but are not in real disagreement. Dr. Burks does not deny that environment can modify intelligence, nor does Freeman dispense with heredity. Both arrive at important but not mutually exclusive conclusions.

The Iowa Controversy

An astonishing theory that a child's environment can not only raise but also lower his I.Q. came recently from psychologists at the University of Iowa. If a child's I.Q. improves when he goes from a poor home to an average foster home, it should improve still more when he goes to an excellent one. Conversely, transferring a child from a good environment to a bad one

*Correlation coefficients were .25 and .50 respectively.

should send his I.Q. down in proportion to the degree of change. The trouble with earlier studies, they contended, lay in the absence of environmental changes large enough to affect the I.Q. greatly. To prove this theory, Prof. BETH WELLMAN and her associates tested youngsters' I.Q.'s before and after they attended the university nursery school, which supposedly represented a definite improvement over their home environments. Without exception the children's I.Q.'s rose. Furthermore during the summer when the nursery school closed, the I.Q.'s slipped back toward their old level. Another study showed that when children were placed in an inferior orphanage environment, their I.Q.'s descended, some even reaching the borderline of mental deficiency.

The most striking Iowa findings concern children of subnormal mothers. Studies by Harold M. Skeels and others revealed that if these children are physically normal and are placed in a good foster home before the age of 3, their intelligence becomes average or in some cases superior.

If the Iowa psychologists are right, their conclusions have tremendous import for education, social work, institutional procedure, and even national policy. For instance, superior early schooling might enable a child with only low average intelligence to succeed later in college. A bad environment could turn a normal youngster into a mental deficient. Or, pleasanter to contemplate, a first rate early environment could make a child of subnormal parents normal or even superior.

Naturally such claims have aroused stormy argument. Some authorities like Paul A. Witty, of Northwestern University, agree that the data seem valid. Others like Terman of Stanford and Goodenough and John E. Anderson of Minnesota object on the ground that too few cases were used and that these cases were not followed up over a period of years; that they were not typical, and were badly selected in the first place. The tests, it is pointed out, were changed during some of the research. Faulty techniques

are cited, and the standards by which the Iowans judged the environments good or bad are declared incorrect or inadequate. Indeed the critics make a devastating indictment of the whole project; the Iowans have defended their research and have been refuting their critics ever since.

Whether or not environment can change I.Q.'s to the extent claimed in the Iowa studies is yet to be confirmed. Meanwhile the controversy continues, and so does research which eventually should furnish the answer.

Environment and Personality

Clearly environment affects child personality in major ways. A child absorbs much from his parents and home surroundings, his school, his friends, and the neighborhood he lives in. But precisely what aspects of personality are affected?

Most students of personality make a distinction between traits, attitudes, and interests on the one hand, and temperament on the other. Temperament refers to deep underlying trends such as energy level and mood, which are rooted in endocrine glands and other organic factors and therefore relatively unchangeable. Traits and attitudes, however, are less dependent on physiological bases and more subject to outside influences. Newman, Freeman, and Holzinger, in their studies of twins, found great difficulty in gauging personality differences, but they agreed that social attitudes depend on environment whereas temperament and the "deeper aspects of personality" do not. Gordon W. Allport presents evidence showing that personality traits like adaptability, aggressiveness, and restlessness change but little over a period of years.

On the other hand, social service records show clearly that many traits important to personal adjustment may be changed radically by a change in environment. This change is clearest in the case of behavior problem and delinquent children placed in foster homes. Take the following case as an example:

Peter was a problem boy of eight who stole from stores and newsstands, begged, set fires, ran away and slept in parks and hallways. He had no father, and his mother proved utterly incompetent to care for him. He was placed in one boarding home after another, always unsuccessfully. The boy was thoroughly insecure, according to the psychiatrist's diagnosis; his bad behavior represented an attempt to gain attention.

Finally a suitable foster home was found. Mr. and Mrs. M. were intelligent cultured persons with a house in the city and a summer cottage in the country. Their sons had grown up and left home, and they were willing to give Peter the love and care he needed. They also enlisted the help of the school principal in carrying out the recommendations of the psychiatrist.

Peter remained in the M. home for three years. For the first few months his problems showed little improvement. He sold Mrs. M.'s watch to a peddler for 25c, smoked, made fires, and prowled through the house at night turning on gas jets. He also attempted to involve neighborhood children in his delinquencies. Despite considerable neighborhood pressure, the M.'s were confident of their ability to help Peter and continued to keep him in their home. Peter gradually began to show improvement and by the third year had made remarkable progress so he was no longer considered a problem at home, at school, or in the community.

Carl R. Rogers, of Ohio State University, summarizes the effects of foster homes. More than 80% of children having personality and behavior problems like bed wetting, masturbation, lying, and insecurity make a good adjustment in foster homes. Influenced by the new environment, their personalities improve. Young delinquents usually benefit less, though 60% or 70% commonly change for the better. Children classed as abnormal show still less improvement. A famous Boston psychiatrist, Dr. WILLIAM HEALY, found that only 40% of these change enough

to be considered well adjusted to their foster homes. Where a child has some hereditary defect like mental deficiency, or an organic injury like a brain lesion, chances of success in a foster home decline further. If a child is under eight when adopted, if the home and parents are carefully chosen and he remains with the family for several years, he is likely to adjust well.

How a child's home, school, and community affect his personality traits and his social adjustment are discussed in Chapter XI.

Interpretation and Summary

Few questions in psychology raise as much controversy as the relationship between heredity and environment. Striking examples of extreme views held by eminent psychologists show the diversity of opinions:

"The potency of environment is not nearly so great as commonly supposed. . . . A child's abilities are determined by his ancestors, and all that environment can do is to give the opportunity for the development of his potentialities. It cannot create new powers or additional abilities." (Rudolf Pintner, 1920)

"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and yes, even beggarman and thief—regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors." (J. B. Watson, 1925)

Research of the last two decades confirms neither extremely hereditarian nor extremely environmentalist positions. We cannot say that "human traits" are entirely inherited or entirely acquired. But we can say that physique and traits closely related to it, like motor abilities, are predominantly determined by

heredity and are little affected by environment. Furthermore, most psychologists agree that heredity is largely responsible for one's level of intelligence. About the extent to which one's I.Q. can be affected by environment, they disagree. Personality is hardest to assign either to heredity or environment. Obviously environment affects many personality traits, including attitudes and interests, more than heredity. But how much environment influences underlying "temperament," if at all, remains a question.

This we can say: heredity provides the raw material from which a person is made. What he becomes, how the material is molded, depends chiefly on environment. Good materials placed in good hands result in a fine finished product. Poor material, no matter how carefully fashioned, never becomes a first-rate product.

CHAPTER VI

Individual Development

PREYER HALL MINKOWSKI WATSON
GESELL SHIRLEY KUHLMANN Terman
ALLPORT BÜHLER
BRIDGES CARMICHAEL MCGRAW

How does a child develop before birth? Is a newborn baby helpless? How can one tell if a child is "normal"? At what ages does a youngster walk and talk? When does a child first become "socialized"? How are maturation and training related in child development?

FOR EACH OF US there is a general life cycle—conception, birth, infancy, adolescence, maturity, senescence, and death. As we progress from stage to stage we change almost miraculously, though so gradually we scarcely notice it. We change not only in physical ways, but in behavior and personality too. The changes result mainly from physical development, yet experience and training affect our behavior and personality growth considerably.

Until late in the nineteenth century no very scientific study was made of just how our behavior changes as we grow up. Among the first to make such a study was WILHELM PREYER, a German physiologist and pioneer experimental psychologist, who kept a

complete diary of his son's growth from birth to three years. He noted how the child's senses of taste, touch, smell, seeing, and hearing developed. He studied reflexes, muscular movements, impulses, and will. From these data Preyer wrote a book, *The Mind of the Child*, which became a classic for child psychology.

Attacking earlier theories that a child's mind at birth is a blank on which experiences later are grooved, Preyer stresses the importance of certain "inherited endowments" that determine a child's mind.

Though later psychologists questioned his findings, his method encouraged scientific procedure.

In America the earliest great child psychologist was G. STANLEY HALL, who founded the first magazine and national organization for child study, and published the first extensive book on adolescence. His "theory of recapitulation" holds that a child passes through stages of development comparable to those in social evolution. In the child's play Hall noted a hunting period, a building period, and other periods like those in mankind's history. Though later discredited, the theory was popular and stimulated much research in genetic and child psychology.

Pre-natal Development

Between conception and birth a human organism spends 280 days in the mother's uterus. The organism develops structurally in that period from the first cell division until the fetus achieves human form at 5 or 6 months.

Behavior beginnings show up less definitely. Action is present in the fetus, as the mother knows, from about 5 months after conception when she feels the first faint thump of arms and legs.

An astonishing experiment on human fetuses was made about 1920 by a Swiss doctor named M. MINKOWSKI. He found that he could keep fetuses alive in a saline solution for a short time after their removal from the mother's uterus. Each time he removed a fetus from a mother for health reasons he kept it alive

and observed its reaction to various stimuli. He found that unborn babies move their heads from side to side, flex and extend their hands and feet. A touch on the skin causes movement throughout the body, including opening and closing the mouth or contracting the eyelid. When the fetus is shifted from a vertical to a horizontal position or otherwise moved, several symmetrical hand and foot movements appear, indicating the presence of a sense of balance.

An important discovery was that older fetuses show more clear-cut specific responses than young ones. A two- or three-months-old fetus (about 3 inches long) reacts to stimulation by moving its whole body. A four- or five-months-old fetus (about 7 to 10 inches long) responds more specifically by moving the parts stimulated. For example, a touch on the lip or tongue elicits a kind of sucking reaction. As the fetus has no chance to learn in the uterus, Minkowski concluded that behavior develops naturally from a primitive, poorly coordinated mass action to more precise and coordinated responses.

This view is confirmed in recent studies by the biologist G. E. Coghill, who studied behavior development in the salamander tadpole, and by the psychologist LEONARD CARMICHAEL, observing behavior in the fetal guinea pig.

The Newborn Child

JOHN B. WATSON, leader of the behaviorist school and a harsh critic of speculative psychology, attacked a problem over which scientists had wrangled for years. Studying newborn children, he tried to discover which, if any, of the many alleged human "instincts" are found in babies. Their presence would support the theory that instincts exist. Their absence, while in no sense conclusive, at least would open the possibility that the so-called instincts are in reality learned reactions, resulting not from any innate tendencies but from experience.

At the Harriet Lane Children's Hospital and Phipps Clinic of

the Johns Hopkins Hospital, he observed hundreds of babies almost daily. Like earlier observers, he found many reflexes, or simple unlearned responses, present at birth. Among them are sneezing, hiccupping, crying, sucking, urination and defecation, responses of head, eyes, hands and feet, including grasping and blinking. He detected no preference for the right hand, contrary to popular belief that right-handedness or left-handedness is inherited. Instead of complex instincts he discovered only three innate emotional patterns: fear, anger, and love. The fear reaction, marked by giving a start, catching the breath, crying, and clutching with the hands, was provoked by loud noises or loss of support. Rage or anger appeared when the child's head was held, or the arms pressed close to the sides; the child stiffened, struggled to escape and screamed or held his breath. Love reactions like gurgling, cooing, and smiling were elicited by stroking, tickling, rocking, or patting.

Watson concluded that the only innate behavior items in a newborn child are the above reflexes and emotional reaction patterns. Other responses of children, including the so-called "instincts" of imitation, rivalry, sympathy, jealousy, or cleanliness must be learned. To show how new emotional reactions can be learned, Watson performed his famous experiments establishing "conditioned fears," described on page 134.

The newborn child's behavior repertoire now is quite fully catalogued, thanks to painstaking studies by recent psychologists, among them Karl C. Pratt, Amalie K. Nelson, K. H. Sun, and Orvis C. Irwin at Ohio State University.

About the sense of vision, they agree that a few hours after birth the pupillary reflex regulates the amount of light entering the eye.

At birth hearing is poorly developed, partly because of liquid in the ears. In the first week, however, most babies respond to sounds like a bell, snapper, tuning fork, or the human voice. Shortly afterwards they respond differently to high and low sounds. Infants awake but inactive seem most sensitive to sound.

Even in the first day of life most babies react favorably when they taste something sweet, and unfavorably when they taste something bitter or sour. Some react to unpleasant smells an hour after birth. In others, the sense of smell develops more slowly.

The skin of a newborn baby responds to heat, cold, and to touch, though some parts of the body are more sensitive than others. Apparently pain is felt very little at first, but sensitivity develops within two or three days, especially in the face and head.

The newborn child is said to sleep about four fifths of the time, though many investigators estimate less. When awake, an infant is active, especially as feeding time approaches. The Ohio State psychologists, using special apparatus, found that from 11 to 43 movements are made per minute, on an average, though only a small percentage could be recorded. Babies twist, turn, stretch, and wave their arms and legs in generalized or "mass" activity. More specific behavior includes the reflexes of sucking, swallowing, grasping a rod or finger, sneezing, yawning, and hiccoughing.

A major infant activity is vocalization. From the "birth cry," when breathing begins, a baby cries when he is hungry, wet, or otherwise uncomfortable. At first one can not distinguish between cries of hunger, pain, and anger, though some mothers say they can as the child grows older. A baby also coos, gurgles, and grunts. In the first month many speech sounds are made, including ow, oo, the short a, yah, m, ng, the hard g, r, and a few others.

Having developed for nine months, an infant at birth stands by no means at the zero of behavior. To various stimuli he makes many responses, some very highly adaptive. More important, his organism is plastic, capable of much development and modification.

Norms of Development

For parents eager to know how their child compares in accomplishments with other youngsters of the same age, ample

criteria are available. Thousands of babies have been studied by psychologists to determine norms for physical growth, motor development, speech, intelligence, emotional and social behavior.

It is important to recall that these norms are only averages. Children differ greatly. Most babies are advanced in some respects, retarded in others. A lag of several weeks or months should cause no anxiety, especially if little training in that activity has been given. Only a definite lag in all types of development should concern parents. Conversely, only if a child ranks significantly above average in all respects can parents consider him an infant prodigy. Even then, unfortunately, they can not be certain.

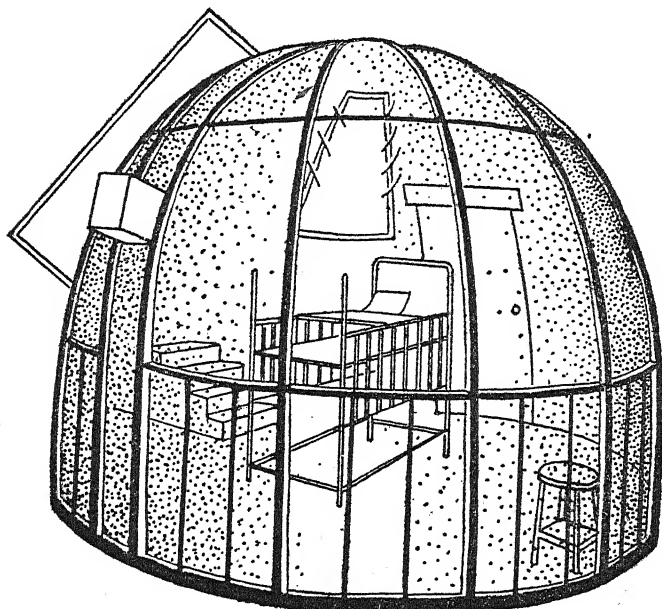
Probably the best known norms are those issued by Dr. ARNOLD GESELL, director of the Yale Child Development Clinic. He believes that only when we know typical development patterns can we interpret individual deviations. For more than fifteen years he and associates have studied children, seeking typical patterns. His procedures are thorough and ingenious. A complete record is kept for each child, including a family case history, results of interviews with the mother, physical measurements, moving pictures of the child's behavior while being tested, and data on a follow-up test. Only normal infants from a homogeneous selection of families are examined. Babies up to six weeks old are examined at home, with portable apparatus. Older babies, brought to the clinic at their longest waking period, usually in the afternoon, are placed in a special crib in a photographic dome. A one-way vision screen surrounds the dome, so the child's behavior can be observed and photographed from outside, without his being aware of observers.

The most important behavior milestones passed in a child's first five years, Doctor Gesell finds, are these, as described in his book *The First Five Years of Life*:

At 16 weeks, having gained control of his eye muscles, the infant focuses on a dangling ring, a cube, possibly even an 8 mm. pellet. He may turn his head on hearing a voice. He recognizes

his mother, can smile broadly when pleased, and likes being held in a sitting position.

At 28 weeks he sits alone, reaches for and grasps a cube promptly, and passes it from hand to hand. He can see a string,



OBSERVATION DOME

though he fumbles in reaching for it, also a small pellet which he puts his hand over crudely but usually fails to get. From cooing he progresses to squealing, uttering vowels, consonants, and syllables. Self-sufficiently he explores the possibilities of toys, perhaps a single toy, oblivious to distractions.

By 40 weeks he stands alone, uses his fingers to poke and pluck, reveals a dim sense of relationships like top and bottom, or cause and effect (the first step toward intellect), imitates facial expressions, gestures, and sounds. Socially he tends toward shyness in presence of strangers, but in general likes to have people around.

Nursery tricks like pat-a-cake can be trotted out for admiring friends.

One year finds him almost, but not quite, walking alone, using a spoon, talking in jargon, placing one block atop another. He creeps with skill, sometimes with speed, throws a ball using his newly acquired ability to release grasped objects, repeats familiar words, and sometimes follows commands. Emotions like anger, fear, affection, jealousy, anxiety, or sympathy appear. Occasionally he seems aware of these feelings in others.

The second year finds him walking, running, speaking words and phrases. He learns bowel and bladder control. A vague awareness of who he is and what belongs to him develops.

When three years old he uses sentences to express his thoughts. A desire to please prompts him to run errands, accept suggestions, heed admonitions. A future exists; he will postpone present pleasure for future satisfaction.

At four he asks endless questions, sees analogies, tries to generalize from his experiences. He tends to be bossy and dogmatic. With little assistance he can dress and undress himself, lace his shoes (but not tie them), and brush his teeth.

By five his motor control is good. He hops and skips. He speaks plainly and lengthily. He prefers playmates to playing alone. Socially he is sensitive, taking pride in clothes and in his appearance. He is self-assured and conforming.

Norms for physical growth in the form of height-weight-age tables are set up by Bird T. Baldwin, educational psychologist, and Thomas D. Wood, physical educator. From them we see that the average child weighs about seven pounds at birth, measures $20\frac{1}{2}$ inches. In 6 months he doubles his weight. In one year he triples it. Boys are slightly heavier and taller at birth than girls. Children grow rapidly for the first two years, then more and more gradually until adolescence. Great individual differences in height and weight appear among normal children, depending

mainly on physical characteristics of parents, somewhat on race and nationality.

Psyche Cattell, a practicing psychologist and daughter of James McKeen Cattell, has drawn up a "dental age scale," showing when teeth erupt and which teeth erupt in the average child between ages 5 and 13. At every age girls are more advanced than boys.

Motor Development

After examining babies from birth to two years, MARY M. SHIRLEY made a schedule of ages at which new motor achievements occur. At 1 month a child raises his chin when lying on the stomach; at 2 months, the chest. At 4 months he sits with support, alone at 7. He stands with help at 8 or 9 months, creeps at 10, walks when led at 11. At 1 year he pulls himself to a standing position by grasping furniture. Fourteen months finds him climbing stairs and standing alone; 15, walking.

Although the age at which these steps occur varies with individuals, the above sequence generally is followed. Nancy Bayley finds the average age of walking alone is 13 instead of 15 months. Between 50% and 75% of children walk at or before reaching 15 months. Failure to walk by this time does not indicate mental retardation, however; possibly the delay results from lack of exercise or walking practice. Wayne Dennis finds that babies prevented from exercising normally learn to sit, stand, and walk considerably later.

Language Development

Although a baby vocalizes from birth, he must *learn* to speak words and know their meaning.

The well-known social psychologist FLOYD H. ALLPORT, of Syracuse University, proposes the "circular reflex" as a key to learning. It works thus: A baby makes random noises, like "da." Hearing himself utter the sound, he is stimulated to repeat

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it. Later an adult saying "doll" causes him to respond "da." Showing a doll to the child while repeating the word establishes a conditioned response, and he learns to say "da" on merely seeing the doll.

While a baby babbles incomprehensible jargon he learns at the same time to comprehend spoken words. Gesell found that 9-months-old babies normally respond to questions like "Where is the kitty?" or "How big is the baby?" At 18 months they pick out a dog in a picture, or throw a ball on command. Comprehension grows rapidly and is an important index of development.

At one year, according to Madorah E. Smith, the average infant uses only two or three words. After 18 months his vocabulary increases phenomenally, as the following table indicates:

AGE IN YEARS	WORDS IN VOCABULARY
1	2 or 3
1½	22
2	272
3	896
4	1,540
5	2,072
6	2,562
18	15,000

Dorothea A. McCarthy, of Fordham University, finds that half of a child's vocabulary at 18 months consists of nouns. This proportion decreases speedily, favoring verbs and adjectives between 18 and 36 months. She finds also that girls' vocabularies exceed those of boys throughout the pre-school period.

Combining words into simple sentences occurs usually around the age of 2. Gesell notes the following samples at 18 months: *see that, bad girl, I do it, open door, gimme cracker*. At 24 months: *Papa gone, I want my cup, you get it for me, I want some more, I don't want to go to bed*. Dr. McCarthy estimates the average sentence length at age 2½ is three words, at 3½ is four words, at 4½ is four-and-a-half words. She finds that when a child reaches 3 or 4 his baby pronunciations disappear.

Mental Development

Mental tests for very young children parallel closely development norms. FREDERICK KUHLMANN and LEWIS TERMAN tried out and standardized tests for age 3 and above. For example, a 3-year-old is asked to name common objects like shoe, watch, or jackknife, and to repeat three digits like 6-4-9 spoken slowly by the tester. At 4, the child selects the longer of two lines, is asked to discriminate common geometrical forms. At 5, he counts four objects, defines common objects like table, fork, hat. The 6-year test includes finding missing parts of pictures and noting differences such as between wood and glass. The 7-year child is asked to detect absurdities in pictures and repeat five digits after the examiner. At 8, he names days of the week, gives similarities between mosquito and sparrow, window and door. The 10-year-old is asked to name twelve animals in one minute and to repeat six digits. At 12, the child can define abstract words like pity, curiosity, grief, surprise, and repeat five digits backwards.

Emotional Development

Disputing Watson's report that fear, anger, and love reactions appear in a newborn child, Mandel Sherman at the University of Chicago found that even experienced judges could not identify hunger, anger, pain, or fear reactions in young babies. Neither could they correctly identify the emotion on hearing the infants' cries.

A Canadian psychologist, KATHARINE M. B. BRIDGES, studying 60 babies daily for several months, discovered only one identifiable emotion in the new infant—a general agitation or excitement. After a month or two, "distress" and "delight" were distinguished. At 4 or 5 months fear, disgust, and anger appeared. At 8 or 10 months came elation and affection, still later jealousy and joy. When a child reaches 2, his emotional responses are many and varied. Emotional development becomes more and

more complex as he grows older and reacts emotionally to countless situations.

Social Development

The Viennese psychologist KARL BÜHLER found that very young wailing infants can be quieted as well by contacts with a hot water bottle or soft cushion as by the mother's caresses. Thus early behavior appears mainly non-social. At about the third month the baby becomes socialized, and thenceforth definitely responds to people.

CHARLOTTE BÜHLER (Karl Bühler's wife), observed the ages at which babies respond to other babies. She found this: At 4 or 5 months an infant notes and smiles at other infants; at 8 or 9 months offers a toy and pays attention to another child's cries. At 9 or 10 months he imitates another's movements but objects to giving up a toy to him.

She noticed also great variation in the social behavior of young children. Some babies between 6 and 18 months appeared "socially blind," paying little or no attention to other children. Others were "socially dependent," highly sensitive to the presence of other children and affected by their behavior. Still others appeared "socially independent," being aware of playmates and often responding to them, but in no way dependent on them. Mrs. Bühler believes that these personality differences are independent of previous social experience, home conditions, or nationality. Though unproved, the theory is supported by evidence that a child's social behavior through several years remains consistent.

Ruth W. Washburn and Arthur T. Jersild, two noted child psychologists, working independently in their study of social reactions, found that followers, leaders, solitary, timid, impulsive, or outgoing children tend to remain the same through the pre-school or nursery school years.

Though social behavior can not be measured by definite cri-

teria, K. M. B. Bridges submits a rough scale for estimating a child's progress. The items include speaking to other children, joining their play, asking another child for help, waiting his own turn, trying to help others, comforting a child in distress, making friendly advances, not claiming others' toys or interfering in their work, not pushing or pulling or hitting or pinching, sharing toys and candy, defending the rights of smaller children, initiating group activities. From these norms, the normal child appears to mature socially during the pre-school years.

Maturation or Training?

Whether behavior changes are a natural unfolding or maturing of the organism, or whether they result from training, is an important point in understanding human development.

In 1872 an English scientist, D. A. Spalding, tried to determine whether birds fly by instinct or by learning. He confined newly hatched swallows in small cages where they could not see other birds. At the normal flying age they were released. Some flew at once. The rest learned very soon. Spalding concluded that learning has little influence compared with innate maturation.

In 1926 LEONARD CARMICHAEL tried a similar experiment. Dividing several frog and salamander embryos into two groups, he allowed one group to develop normally. The other he put in an anesthetizing solution that prevented swimming but permitted internal neuromuscular maturation. After the normal tadpoles could swim expertly, the drugged tadpoles were placed in fresh water. In half an hour the latter swam as well as the former. This suggests that motor development depends on physiological maturation, not practice.

Less conclusive results emerged from a study of pecking in chicks. John F. Shepard and Frederick S. Breed discovered that a baby chick, permitted to peck freely from birth, requires a week or more to learn accurate pecking. Chicks isolated at birth and fed with a dropper for five days learned to peck accurately

in about half the time required by a newborn chick. Again maturation appears important, though practice helps achieve maximum skill.

Arnold Gesell, Helen Thompson, and L. C. Strayer studied maturation and training in a pair of identical twins. At 46 weeks one twin was trained to climb stairs and build with blocks. The other twin, left to her own random efforts, climbed stairs as well as her sister in two weeks, acquired equal block-building skill in six weeks. The importance of maturation again appeared in acquiring vocabulary. At 84 weeks one twin was trained for five weeks to use words and name objects. At 89 weeks the other twin was trained for four weeks. In four weeks the latter achieved more than her sister did in five, presumably because of her greater maturity.

The famous "Johnny and Jimmy" experiment with twins by MYRTLE MCGRAW shows, on the other hand, striking effects of training. Trained rigorously from the age of 20 days, Johnny at 8 months swam seven feet, at 14 months, fifteen feet with his face under water. When less than a year old he was put on roller skates. At 15 months he skated proficiently. He climbed steep slides at 11 months, jumped skillfully from a five-foot pedestal a few months later. Jimmy, later coached in the same activities, made up for lost time though he seldom quite caught up to Johnny.

With simple motor activities training produced little effect. Practice in hanging by the hands, grasping objects, creeping, sitting, and walking did not make Johnny superior to Jimmy in these respects. Both twins took a few tottery steps alone at 9 months, though Johnny was given stepping practice from the first month of his life. Jimmy, in fact, learned to ride a tricycle faster than Johnny. The latter, patiently pushed up and down a corridor on his tricycle for 7 months, made no more headway than his neuromuscular coordination permitted, and he got

bored. Jimmy, given the tricycle when he was ready for it, pedaled away with glee.

Dr. McGraw believes in steering a middle course between constantly egging the child on, and sitting back to let nature take its course. At a certain time nerves and muscles are ready for each new activity; at this stage training and practice are beneficial. Practice given too early is useless.

Both maturation and training are essential processes in individual development. Maturation controls physical growth and the time of appearance of simple motor activities like reflexes, grasping, or crawling. Though psychologists differ about the importance of training in bringing about sitting and walking, they agree that in more complex activities like stair-climbing or talking, specific practice must occur. But only when an organism reaches a certain stage of physical development will training be fully effective.

CHAPTER VII

Physiological Bases of Behavior

DESCARTES BELL WEBER FECHNER
HELMHOLTZ HERING MÜLLER LADD-FRANKLIN
FLOURENS BROCA FRANZ LASHLEY POFFENBERGER
HALL DONDERS WUNDT CATTELL KRAEPELIN
CANNON MOSSO HOLLINGWORTH HULL



By what mechanisms do we see colors and hear sound? How does the nervous system work? Are our various functions localized in certain parts of the brain? What is a reflex? Upon what does our reaction time depend? How do alcohol and caffeine affect efficiency? In what ways may endocrine disorders affect personality?

WE BEHAVE NORMALLY only when our senses, muscles, glands, brain, and nervous system are intact and functioning well, and when we are free from fatigue and the effects of drugs. By studying our bodily states physiological psychologists have contributed much to the understanding of human behavior.

Pioneers of Psychophysics

ERNST HEINRICH WEBER, a professor of anatomy and physiology at the University of Leipzig, was the first to make an extensive study of sensation as it relates to behavior. His discoveries about the skin and muscle senses have become famous.

He placed one hand in a bowl of hot water, the other in a bowl of cold water, then both in lukewarm water. In the lukewarm water the first hand felt cold, the second hot. From this he concluded that the sensation of cold results from a drop in skin temperature, while hot results from a rise. The theory holds for moderate, though not extreme temperatures. Weber distinguished between the sense of touch, whose receptors (end-organs for receiving stimuli) lie in the skin, and the muscle sense whose nerve endings lie within the body. That the kinesthetic or muscle sense is important he showed by demonstrating how much more accurately subjects can judge weights when they "heft" them than when the weights are merely placed on the skin surface.

Weber is best known for initiating "psychophysics" (a name applied later), which deals with the cause-effect relation between physical stimuli and resulting sensations. Particularly he wanted to know how much a given stimulus must be increased or decreased to bring about a "just noticeable difference." With lifted weights Weber found that an increase of about $1/30$ can be just barely felt, on the average. Thirty ounces can be distinguished from 29, as can 15 from $14\frac{1}{2}$. The ratio remains constant. In judging lengths of lines the ratio is $1/100$; a line 101 mm. in length is judged longer than one of 100 mm. This principle that we notice relative rather than absolute changes in stimuli later was called "Weber's Law."

A colleague of Weber, GUSTAV THEODOR FECHNER, a professor of physics at Leipzig, tried to bridge the gap between mind and body. In Weber's work he saw possibilities for discovering a mathematical relationship between the mental and the physical. After years of labor he gave the world a significant but difficult book called *Elements of Psychophysics*. Its value lies mainly in presenting ingenious methods of testing sensitivity thresholds. The methods have been used ever since to devise aptitude tests and other measures of individual differences. In his experiments Fechner used lifted weights, light intensities, and various tactual

and visual situations. His conclusions elaborated Weber's Law thus: "When stimuli increase by a constant ratio, the sensations aroused by them increase by equal increments or steps." As stimuli increase in geometrical ratio, sensations follow in arithmetical ratio, that is, by one sensation unit or "just noticeable difference."

Though Fechner made numerous valuable contributions, he failed to span the chasm between mind and body, a feat which remains for some super-scientist of the future.

Helmholtz on Eyes and Ears

The dominant figure in nineteenth century German science was HERMANN LUDWIG VON HELMHOLTZ, a physicist, physiologist, and psychologist. Trained in medicine, he turned to teaching and research. While still in his thirties he began to publish brilliant findings on vision and hearing. To facilitate more accurate study of the eye, he invented the ophthalmoscope, which permits direct observation of the retina. Experimenting on the external eye muscles, he showed how the lens focuses to accommodate vision at different distances.

A famous Helmholtz theory explains how we distinguish colors. Elaborating work of an English physicist, THOMAS YOUNG, he developed the "Young-Helmholtz" theory that three kinds of receptors, or end-organs, exist in the eye, one reacting to red, one to green, and one to blue-violet. Color is determined by light of a certain wave length. A wave length corresponding to saturated green arouses only the green receptor. Yellow arouses both red and green receptors, but to a lesser degree because its wave length lies between green and red. White light, synthesizing all colors, arouses all three receptors at once. The usual forms of color blindness result from a lack of red or green or both these end-organs. Though it fails to account for all the facts, Helmholtz's theory remains one of three notable attempts to explain

color vision. His remarkable *Physiological Optics*, published in 1861, was translated into English and used in this country as a text as late as 1924.

Turning his attention to hearing Helmholtz studied both structure and function of the ear, and issued the classic "piano theory." It accounts for our ability to hear different tones by the presence of fibres on a membrane of the inner ear, each of which corresponds to a different pitch and vibrates sympathetically with it, like a piano string.

Interested in music, Helmholtz helped solve the mystery of tone qualities and tonal relationships. He explained why the same note sounds different when played on different instruments like piano, violin, and flute, though the number of vibrations, or sound waves per second, is identical in each case. Differing patterns of overtones, or partial vibrations determined by the structure of a musical instrument, cause variations of quality or "timbre," he said. In fact he actually changed overtones by using resonators that artificially produced notes resembling various musical instruments.

Helmholtz also developed theories of discord and harmony in terms of overtones. Notes near each other in pitch seem dissonant because their overtones cause pulsating "beats." Harmony depends largely on simple ratios of vibration. Some pleasant combinations are notes an octave apart having a vibration ratio of 1:2; a major fifth having 2:3; a major third having 4:5. Harmony, however, is not merely pleasing vibrations. Mature stages of both individual and cultural development bring a preference for more complex tonal intervals and combinations, Helmholtz pointed out.

Temperature and Color according to Hering

EWALD HERING, a professor of physiology at Prague, modified Weber's theory for warm and cold sensations. The skin of a hand

placed in cold water adapts to the water temperature, Hering said. Any stimulus warmer than the newly established skin temperature is felt as warm, though actually it may be cold. Likewise anything lower in temperature is experienced as cold. Hering thus dismissed the notion of an absolute zero and substituted a relative zero point dependent upon existing skin temperature.

Hering found four primary colors—red, green, blue and yellow—as against Helmholtz's three. He noted that certain pairs of colors, mixed together, give gray. This is true for red and green, blue and yellow, white and black. The colors forming such pairs are "complementary." Also, Hering knew that after looking at red a person gets a green sensation or after-image, and that blue gives a yellow after-image. To account for these phenomena, he proposed three kinds of receptors in the retina, the most sensitive part of the eye. One responds to red-green, one to yellow-blue, one to white-black. Red, yellow, and white cause a "tearing down," or *catabolic*, process in their respective receptors. Green, blue, and black cause a "building up," or *anabolic*, process. When both processes occur together, as when complementary hues are seen simultaneously, a neutral, medium gray results. When we stare at red for several seconds, excess breakdown of that receptor occurs, which subsequent building up offsets. The building up gives the green after-image.

Color blindness, according to Hering, results from impaired or destroyed red-green substance in the eye. Color-blind persons usually can distinguish yellow and blue, indicating that their yellow-blue substance is unimpaired.

An interesting elaboration of Hering's theory was proposed by CHRISTINE LADD-FRANKLIN. Assuming that the vision of primitive man was colorless, capable of distinguishing only white, gray, and black, she suggested that the white receptor in time separated into yellow and blue, and the yellow later subdivided into red and green. If this is true, possibly in some distant future—

thousands or millions of years hence—the red or green molecule will break down and yield two completely new colors!

Other Physiologists' Researches on Sensation

Among other notable findings on the sensations is JOHANNES VON KRIES' "duplicity theory" of vision. He showed that, of the retina's two types of end-organs, the "cones" discriminate color and the finer kinds of form. The more widely distributed "rods" respond only to the light intensities, white, gray, and black.

MAX VON FREY found that the four skin senses—pressure, pain, warmth, and cold—have different end-organs. Neither he nor later investigators, however, have been able to show just which of the skin's tiny cells, bulbs, and corpuscles act as receptors for which senses.

That only four taste qualities exist—sweet, salt, sour, and bitter—was proved by Friedrich Kiesow. On the other hand, smell was classified by Hendrik Zwaardemaker under nine categories, each having several subdivisions. Later Hans Henning, admitting countless specific smells, reduced Zwaardemaker's list to six main qualities: fragrant, fruity, resinous, spicy, putrid, and burned.

Instead of five senses the physiological psychologists have shown that there are no less than ten or twelve distinct kinds of sensation. We have mentioned: the four cutaneous senses (pressure, pain, warmth, and cold); the kinesthetic or muscle sense; as well as the familiar senses—vision, hearing, taste, and smell. Early physiologists also demonstrated the existence of a sense of position, or equilibrium (balance), or of movement of the body as a whole, sometimes called the "labyrinthine sense," with end-organs in the semicircular canals of the inner ear. In addition some authorities now refer to various "organic senses," including hunger and thirst. Hence one may properly speak of at least ten senses, each having its own end-organs and each yielding a different kind of experience.

Early Studies of Brain and Nervous System

An important discovery about the action of the nervous system was made by SIR CHARLES BELL, a British doctor and physiologist of the early nineteenth century. He found that nerves differ in function. Some are sensory, connecting receptors in the skin, ear, or eye with the spinal cord. These nerves enter the cord on the dorsal (back) side. Others are motor nerves, leaving the spinal cord on the ventral (front) side, and going to the muscles. This principle often is called the Bell-Magendie law, because a Frenchman, FRANÇOIS MAGENDIE, discovered the same thing independently a few years later. Bell also suggested, though he did not actually prove, that each sensory nerve serves only one sense, like vision or hearing, not several senses at once.

Carrying Bell's idea further, JOHANNES MÜLLER, professor of physiology at Berlin, elaborated the famous doctrine of specific energy of nerves. He proved what Bell offered as theory, that each nerve has its own special sensory or motor function. It was not clear in his mind whether sensory experience like seeing or hearing results solely from stimulation of the visual or auditory nerves, or from stimulation of a specialized brain center. Later he inclined toward the first explanation, possibly because the second smacks too much of phrenology, which already was suspect in scientific circles.

Thanks to Franz Josef Gall and an associate named Johann Gaspar Spurzheim, the so-called "science" of phrenology had soared to popularity shortly after 1800. A person's intellectual and emotional faculties can be estimated, said these men, by the bumps on his head. A bump in a certain place indicates conscientiousness, another shows conjugal love, another suavity, another self-esteem. The bigger the bump, the more pronounced the characteristic. Imposing charts locating all the faculties were drawn up. Though phrenology won the support of a few prominent scientists, most opposed it. Actually it served a purpose by

stimulating its opponents to make scientific studies of brain functions.

While phrenology flourished, a French anatomist, PIERRE FLOURENS, was performing operations on the brains of pigeons. He discovered that removing the cerebral lobes, or upper parts of the brain, impaired hearing, seeing, remembering, and "volition." Removing a lower part, the cerebellum, caused loss of coordination. Two other parts of the brain showed special functions. But Flourens also noted a unity of action in the brain and nervous system, and found that a function lost on removal of its brain center can be reacquired—a principle corroborated almost a century later by Lashley.

A significant discovery about the human brain was made in 1861 by a Paris physician named PAUL BROCA. He became interested in a patient who could not talk, though mentally fit and in no way paralyzed. When the patient died, Broca found a lesion in the third left frontal convolution of his brain. Broca concluded that this area is the speech center. In fact it is now called "Broca's area."

After studying soldiers with head wounds from the Franco-Prussian war, two German surgeons, G. FRITSCH and E. HIRTZIG, turned to brain experiments on animals. They found that a weak electrical current applied to certain parts of exposed brains calls forth specific body movements. Brain centers controlling muscles of the face, neck, and legs were located. Other researchers quickly adopted the same technique. Using monkeys mainly, they soon mapped out the chief sensory and motor areas of the brain. Thus many functions were found to depend upon specific parts of the brain, but this was a very different kind of localization from that claimed by phrenologists.

Brain Functions

A new aspect of brain functions appears in the recent work of SHEPHERD I. FRANZ and KARL S. LASHLEY, American psy-

chologists. Franz taught cats and monkeys to escape from problem boxes by pushing a button on the door. Removing parts of their frontal brain lobes, he found that the new accomplishment was lost, though older habits like eating and scratching persisted. After checking his results, Franz concluded that the frontal lobes are brain centers for new activities though these functions may later transfer to other parts of the brain.

Lashley experimented similarly on white rats. After they learned how to escape a problem box, he removed various sections and amounts of the cerebral cortex, the sensitive outside layer of the brain. An astonishing fact emerged. Not the specific area, but the *amount* of cortex removed determined how much of the habit was lost. In other words, retention of a new habit depends on the amount of brain tissue left intact. Furthermore, rats that lost their new habits when operated on were successful in relearning them in proportion to the amount of cerebral cortex remaining.

The experiments of Franz and Lashley do not disprove the location or "localization" in the brain of simple sensory and motor functions. They merely show that no one part of the brain is essential to learn fairly complex activities. Even when an operation disturbs an existing habit, another part of the brain takes over the work of the destroyed section and the habit can be relearned.

Transferring these principles to human psychology, Franz re-educated persons whose behavior was disturbed by brain lesions. Other cortical areas apparently "pinch hit" for the damaged parts.

Human brain operations often yield interesting results. To remove a brain tumor Dr. Richard M. Brickner of New York had to remove most of a certain patient's frontal lobes. No apparent injury to the sensori-motor functions resulted. But the patient's behavior changed astonishingly. He became restless, distracted, jittery. He shouted, sang in a loud voice, danced

about, and boasted without restraint. Brickner concluded that the man had lost his ability to combine or synthesize, thus could not think out a problem, plan ahead, or restrain his impulses.

Reflexes

The great seventeenth-century French philosopher, RENÉ DESCARTES, distinguished between animals' automatic mechanical acts and the voluntary rational behavior of human beings. However, even man showed much automatic non-rational activity that depended on mechanical action of the nervous system. To this activity the name "reflex" was applied a century later.

During the French Révolution Dr. P. J. G. Cabanis wondered whether the guillotine caused pain in those it decapitated. His grim speculations led to research and later a theory that human activity occurs at three neural levels. According to Cabanis, the lowest or spinal cord level serves in reflex acts. A middle level functions in semi-conscious, semi-integrated activities. The highest level commands thought, volition, and other complicated functions.

Thirty years later a Scottish doctor named MARSHALL HALL, studying blood circulation in animals, noted that beheaded animals make muscular responses to stimuli. Studying beheaded animals further, he formed the first clear-cut definition of reflex action: unconscious movement that depends on the spinal cord and is independent of the brain.

Shortly afterwards Hall's work was elaborated in Johannes Müller's tremendous *Handbook of Physiology*. Müller himself studied reflexes in frogs and defined the reflex in neurological terms: stimulating a sense organ sends an impulse along the sensory nerve to the spinal cord, where it connects with a motor nerve, and travels to a muscle, resulting in action. Müller's book cleared up much that had not been understood about reflex action, though cataloguing human reflexes and studying their interaction was left to later neurologists and psychologists.

Reaction Time

Interest in reaction time dates from 1795, when the astronomer of Greenwich Observatory near London dismissed his assistant for being slow to observe the exact time a star crossed the telescopic field. Astronomers thereafter noted great individual differences in speed of observing. This they called "the personal equation."

One theory held that the speed of nervous impulse varies with individuals. Helmholtz actually measured how fast it travels in human sensory nerves. He found it 200 or 300 feet a second. Measuring the complete time that elapses between stimulation of a sense organ and muscular response, he got such varying, inconsistent results that he gave up the experiment. Nevertheless, it was the first scientific study of reaction time.

Soon afterwards F. C. DONDERS, a Dutch physiologist, considered the psychological steps occurring between a stimulus and response. He found a "simple" reaction time, wherein a subject makes a prearranged response immediately upon perceiving the stimulus. A "discrimination," or "choice," reaction time appeared also, in which the subject differentiated stimuli before responding. The "choice" reaction time was one tenth to one twentieth of a second slower than the "simple" reaction time. This fraction of a second, Donders concluded, measures the time required to discriminate.

WILHELM WUNDT attacked the same problem. Like Donders he measured the speed of complex reactions involving discrimination, will, and association. From the time they required he deducted the time taken for simple reactions. His project struck a snag when OSWALD KÜLPE and JAMES McKEEN CATTELL showed that the two reactions involve different mental processes. Hence one can not be subtracted from the other. They further pointed out that the attitude, or mental "set," of a subject just

before stimulation occurs greatly affects the speed of reaction time.

James McKeen Cattell and Ludwig Lange revealed the interesting fact that when a subject concentrates on the stimulus he reacts more slowly than when he concentrates on his response. The former attitude they called "sensorial"; the latter, "muscular." An example may make this distinction clearer. A motorist, stopped at a traffic light, exhibits the sensorial type of reaction, because he concentrates on the stimulus and makes his response automatically. In contrast, a runner, all set to leap forward at the sound of the starting gun, fixes his attention upon getting away as quickly as possible. His mental set helps facilitate his reaction, but he may respond to wrong stimuli such as an onlooker's shout of "Go!"

Cattell and his students probed every aspect of the reaction-time problem. They found that we react faster to touches, electric shocks, and sounds than to lights or other types of stimuli. Practice and fatigue affect reaction speed very little, though distraction slows it considerably.

How drugs affect reaction time was first studied by EMIL KRAEPELIN, a colleague of Cattell at Leipzig. Coffee and tea shorten the time slightly, he found, but anesthetic drugs lengthen it. Alcohol first speeds up reaction time, then, taken in larger quantities, slows it down.

Wide individual differences appear in reaction speed, also in susceptibility to stimulants and drugs. To Cattell goes credit for arousing interest in these individual differences—an interest which grew to have important applications later in aptitude testing.

Drugs and Toxic Products

In the association experiment, where a subject says the first word that comes to mind when he hears a stimulus word, Kraepelin found that alcohol induces a less direct, more superficial type

of association. That alcohol actually does not stimulate, but depresses is shown by Raymond Dodge and Francis G. Benedict. Using moderate doses of alcohol (30 and 45cc.—about 2 or 3 cubic inches), they noted uniform decreases in sensitivity, in reflexes, and in reaction time.

HARRY L. HOLLINGWORTH studied the effects of alcohol on mental and motor efficiency. Even the small quantity found in three or four bottles of beer caused a loss in hand steadiness, tapping speed, in eye-hand coordination, memory, naming opposites, and adding. Only the pulse rate speeded up with alcohol.

Caffeine, on the other hand, proved a real stimulant, according to Hollingworth. Two cups of coffee speeded up motor activity by about 4%, but decreased muscular steadiness. Larger doses taking effect within two hours and lasting until the next day increased speed of response in simple mental tests like naming colors, though small doses retarded the rate. Typing speed improved with small doses, but not with large ones. To disturb sleep more than two cups were required by most of Hollingworth's subjects.

CLARK HULL of Yale studied the effect of pipe smoking on mental efficiency. The pulse rate rose, and subjects were shakier after smoking. Except that non-smokers, after smoking, lost accuracy in adding, no appreciable effects appeared.

Effects of Fatigue

In recent years workers' rest periods have become a part of the program of every efficiently run industrial plant. Efficiency experts find that carefully planned rest periods can increase daily output by a sizable percentage.

Early proof that fatigue reduces efficiency was cited by Kraepelin. He had subjects add columns of figures, giving them rest periods at various intervals. Checking the amount of work done, he drew up a "work curve," which showed changes in output due to fatigue, practice, "warming up," and voluntary spurts.

Almost all later research on fatigue follows Kraepelin's procedure.

In 1890 an Italian scientist, ANGELO MOSSO, invented the "ergograph," an apparatus which measures efficiency changes accompanying fatigue of finger and hand muscles from lifting a weight. He found that a finger, exhausted from lifting a weight 30 times, requires two hours' rest to recover completely. After only 15 lifts, recovery occurs in half an hour. In other words, the recovery from muscular work takes place much faster when the muscle is not completely exhausted. This important principle applies directly to industry, where maximum production is sought.

Output loss from fatigue, though varying with individuals and with the nature of the task, was estimated by Tsuru Arai, Japanese physiological psychologist, to be 5% at the end of an hour. Loss increases in rough proportion to the amount of time worked, up to 100% at the end of eleven hours' continuous work.

That mental work causes bodily changes similar to those accompanying physical work was an astonishing fact revealed by Francis G. Benedict, chemist, and T. M. Carpenter, physiologist. In taking a written examination, subjects eliminated more than normal water vapor and carbon dioxide, absorbed more oxygen and gave off more heat, just as in physical activity.

With some types of work, on the other hand, feelings of fatigue do not indicate lowered efficiency. ALBERT T. POFFENBERGER discovered that when subjects completed unfinished sentences, working continuously for five hours, output did not change. Nor did it change when they judged the merit of compositions. On intelligence tests their performance actually improved after five hours. Presumably fatigue effects were offset by the facilitation of practice. Yet in all cases increasing feelings of fatigue were reported.

Endocrine Glands

Just before 1900 physiologists began to report amazing facts about the endocrine, or ductless, glands. These glands, called by Claude Bernard "glands of internal secretion," discharge their secretion, known as a "hormone," into the blood stream. In this they differ from the duct glands, like salivary, tear, and sweat glands, which pour out their secretions at or near the body surface.

For some time psychologists did not realize the connection between endocrine glands and human behavior. Then in 1915 WALTER B. CANNON, the Harvard physiologist, wrote *Bodily Changes in Pain, Hunger, Fear and Rage*. Psychologists sat up and took notice. Cannon showed that during intense emotional states the adrenal glands, located near the kidneys, discharge a hormone into the blood stream. This adrenal hormone, called adrenin, energizes the whole organism, preparing it for emergency action by stepping up blood pressure, increasing sugar content in the blood, sending blood to the extremities and causing it to coagulate faster if exposed to air, and the like. Knowledge of adrenal functions opened up new possibilities for understanding the emotions.

As endocrinologists reported on other glands, psychologists noted their profound effects on human behavior. The thyroid, located in the neck near the windpipe, influences physical and mental growth. As already described in an earlier chapter, undersecretion of the thyroid in an infant causes "cretinism," a condition of serious physical and mental retardation. Deficient thyroid functioning in adults, called "myxedema," causes inactivity, listlessness, increased weight, puffy skin, and loss of hair. On the other hand, oversecretion of the thyroid produces restlessness, nervousness, and increased metabolism or energy consumption.

An interesting case of thyroid malfunction is presented by Florence Mateer. A 4-year-old boy deficient in thyroid had an

I.Q. between 50 and 60, was overweight, had dry skin and hair and showed other physical symptoms of "hypothyroidism." When glandular extract called "thyroxin" was given he began to improve. After 5 years his I.Q. reached 90; his appearance and general behavior were normal. Then through family negligence the thyroid treatments were dropped. Soon his school work became worse, and his intelligence quotient fell off. Before long he became a behavior problem. Other factors than glandular ones doubtless complicated the case, but it suggests how seriously an abnormal glandular condition can affect behavior.

Improper functioning of other endocrine glands also interest the psychologist. Oversecretion of a hormone from the pituitary, located at the base of the brain, causes gigantism. Robert Wadlow, an Illinois lad almost nine feet tall at 22, was a hyperpituitary case. Undersecretion of the same hormone produces one type of dwarfism. The pituitary gland also helps regulate sexual development, as do, in all probability, two other glands: the pineal in the brain and the thymus in the upper chest. Dysfunction of the parathyroids, four small pea-like bodies found near the thyroid, causes severe cramps and spasms.

Other organs also have endocrine functions. The so-called "Islands of Langerhans" in the pancreas secrete the important hormone, insulin, the lack of which causes diabetes. Hormones from the liver, largely a duct gland, serve to regulate the chemical content of the blood. The sex glands are duct glands, but related cells have endocrine functions which produce at adolescence the physical changes called "secondary sexual characteristics." These include distribution of bodily hair, development of mammary glands and of fatty tissue, and changes in voice.

Much is still to be learned about the functioning of endocrine glands. They operate as an interconnected system, which makes it difficult to isolate the functions of each gland. Their importance, psychologically, lies in their effect upon energy level, upon physical and mental development, and upon emotional behavior.

CHAPTER VIII

Motivation

DESCARTES JAMES THORNDIKE MCDUGALL
WOODWORTH BERNARD DUNLAP WATSON YERKES
WARDEN ALLPORT THOMAS SHAFFER
TOLMAN LEUBA HURLOCK WYATT

Are there any "instincts"? How does the psychologist classify human urges and desires? What is the difference between a drive and a motive? Which are the strongest drives? The strongest motives? What is an incentive and how does it operate? Which incentives are most effective?

TELL almost any psychologist today that somebody does something "instinctively" and he is apt to rise in indignation and point out that instincts were thrown overboard twenty years ago. Little or no human behavior is instinctive, he will declare. Practically everything we do is wholly or partially learned, not the unmodified expression of an inborn urge.

RENÉ, DESCARTES spoke of man's "intelligent" behavior as against animals' "instinctive" behavior. This notion lost favor after Darwin, when man's relation to animals was shown. Human instincts began to be noted. By the late nineteenth century philosophers and psychologists were drawing up elaborate lists.

WILLIAM JAMES claimed that man has more instincts than

any other animal. He compiled a long list that includes sucking, crying, locomotion, curiosity, sociability, shyness, cleanliness, pressing downward on the feet, imitation, pugnacity, sympathy, fear of dark places, acquisitiveness, love, jealousy, and many more. James added, however, that instincts can be modified by habit.

Instinct theories were furthered by WILLIAM McDUGALL, who interpreted all behavior, even social behavior, as an expression of innate impulses. His list of major and minor instincts includes flight, repulsion, pugnacity, curiosity, mating, food seeking, acquisitiveness, sneezing, and laughing. Instincts, he said, are the equipment by which man perceives certain stimuli, experiences emotion, and acts in a certain way. Perception and action can be modified, but emotions remain the core of instinct and change very little. This view found favor with many psychologists and others.

A few years later EDWARD L. THORNDIKE listed more instincts, giving examples. Gregariousness he illustrated with "restlessness when alone," "interest in the behavior of others," and "satisfaction in admiring glances," among others. He mentioned also sex behavior, maternal and paternal behavior, fighting, anger, mastery, submission, fear, disgust, food getting, and acquisitive responses. Thorndike disagreed with McDougall's argument that instinct is mainly emotional. He preferred calling it simply unlearned behavior.

Just before and during World War I instinct theories flourished. The term instinct was not used by psychologists only. The economist Thorstein Veblen called one of his books *The Instinct of Workmanship*; Wilfred Trotter, a sociologist, wrote *Instincts of the Herd in Peace and War*. Ordway Tead, a personnel specialist, named a book *Instincts in Industry*. The psychoanalyst Sigmund Freud proposed two fundamental instincts: the sexual and the self-preserved. Freud's one-time associate, Carl G.

Jung, founder of "analytical psychology," called the nutritional, sexual, and herd instincts primary.

In 1924 the sociologist, LUTHER L. BERNARD, in a book called *Instinct* surveyed the work of about 400 authors and showed the ridiculous extremes to which instinct theories were being carried. He found the terms "instinct" or "instinctive" applied to almost 6,000 urges or activities! Some, like sex or social behavior, were generalized; others, astonishingly specific, like an "instinct to avoid eating the apples in one's own orchard" or "an instinct to insert the fingers into crannies to dislodge small animals hidden there."

Not all psychologists, however, believed that the activities called instinctive are innate. They might be learned. ROBERT M. YERKES and Leonard Bloomfield showed that mouse killing in kittens is at least partially learned. Others pointed to what pet-lovers often observe, that a puppy and kitten reared together do not show the alleged "instinctive hatred" between cats and dogs.

Two outspoken critics of the prevailing concept of instinct were KNIGHT DUNLAP and JOHN B. WATSON, Johns Hopkins psychologists. Both insisted that most human behavior, especially adult behavior, is greatly affected by learning and therefore not innate. Watson showed from his studies of babies that fears and right- or left-handedness are acquired through experience, and that crawling, standing, walking, and numerous other activities are partially learned.

It began to dawn on psychologists that the term "instinct" was being used in two different ways. Sometimes it referred to a kind of behavior such as sucking, fighting, or fear of dark places; sometimes to impulses or urges like sex, hunger, or acquisitiveness, that lead to behavior. ROBERT S. WOODWORTH applied the term "mechanism" to behavior or activity, because it needs something to start it going. The impulse or urge prodding us to act he called "drive," likening it to the power that makes a machine operate. The two cannot be distinguished sharply, be-

cause a mechanism, once started, can furnish its own drive. For example, a child induced to learn singing will, if musical, be carried along by enthusiasm growing out of his singing. Any habit, says Woodworth, contains its own motivating power and exerts a drive toward being repeated. A person's drives naturally change as he forms new habits and behaves in new ways. Hence Woodworth criticised McDougall and others for asserting that all human motivating power comes from a few instincts.

Bernard, Dunlap, Watson, and Woodworth began the overthrow of instinct doctrines in psychology. Anthropologists finished the job by showing that human urges and behavior differ the world over according to the cultures in which people live. Let us see what some noted anthropologists report.

Instead of an "instinctive love of one's own children," William H. R. Rivers found among the Murray Islanders in the Torres Straits indifference to the real parentage of a child. Adoption is common, and children do not know who their real parents are. Furthermore, among these people of Murray Island a child may be put to death if a family has too many of the same sex.

Ralph Linton reports an unusual custom in one Madagascar tribe. If a divorced woman remarries, her former husband receives the first three children from the new union; he treats them like his own.

Margaret Mead notes that the fathers, not the mothers, in the Manus tribe of New Guinea bring up the children. Perhaps for that reason she found that boys rather than girls liked the dolls she presented to them!

Fighting, which is supposedly a human instinct, is unknown in some primitive communities. Studying the Kwakiutl Indians of the Canadian Pacific region, Franz Boas found that quarrels are settled not by physical combat but by holding a "potlatch," or feast, at which possessions are given away. The one who gives away most property wins. Alexander Goldenweiser discovered

that disputes among persons in certain Eskimo tribes are settled by a singing contest, the victor being chosen by popular vote.

Most psychologists who have discussed instincts have included acquisitiveness in their lists. Yet anthropologists find incredibly different attitudes toward property among primitive peoples. In one community every rock and water hole is privately owned. In another only a few items like ornaments and tools are private; everything else is owned in common.

Competitiveness varies greatly among cultures. Ruth Benedict notes that Zuñi Indians frown on a person who seeks prestige or power. A man who consistently wins races is prevented from entering contests. Individual initiative is discouraged. Otto Klineberg, a social psychologist, found it impossible to test accurately the intelligence of many Indian tribes because the members could not grasp the idea of competing to achieve a high score.

Thus many so-called instincts vary widely from group to group, depending on the customs in each culture. Instinct is defined as "innate, relatively unchangeable behavior that is universal to a species." Nest-building in birds or web-spinning in spiders are true instincts. Because most forms of human behavior are so variable and modifiable, psychologists have dropped the term "instinct" when speaking of human beings.

Drives

Human behavior obviously arises from some urge. If not from an instinct, then from some other kind of urge. Animal psychologists adopted Woodworth's term "drive," meaning the energy that sets things going. Later it was accepted generally to mean energy or action arising from physiological needs like hunger, thirst, sex, fatigue, elimination of bodily wastes, maintenance of constant temperature and barometric pressure.

Physiologists already had studied hunger. Just before World War I, WALTER B. CANNON of Harvard and ANTON J. CARLSON of Chicago found that hunger springs from rhythmic contrac-

tions of the stomach walls. Later a Japanese psychologist named Tomi Wada showed that when a person is moderately hungry, general muscular activity and mental alertness increase.

Ging Hsi Wang, Chinese physiologist and psychologist, noted the effect of sex on the activity of the female white rat. Each day he checked the rat's runs in a revolving squirrel cage. Every four days, when the rat's heat, or oestrous periods, occurred, it made almost twice as many revolutions of the cage as normally. No such fluctuations of activity occur in the male, the prepubescent female, or in the female during pregnancy or lactation. Wang showed conclusively that the sexual cycle greatly affects a rat's energy.

The connection between glands and drive was demonstrated by Curt P. Richter, Johns Hopkins physiologist. Castrated rats, or rats whose adrenal, pituitary, or thyroid glands are removed, show amazing loss of activity. From several thousand daily revolutions of the activity cage they drop to only a few hundred.

Curious tie-ups between the drives appear. Studying the effects of thirst on rats, Lucien H. Warner found that lack of water reduces the hunger drive. Hunger weakens the sex drive, Fred A. Moss discovered. Several young men who reduced their diet for an experiment reported their sex urge and sexual interest considerably lessened during that period, according to Walter R. Miles.

To calculate the strength of drives, CARL J. WARDEN, of Columbia University, devised an obstruction box. A rat motivated by hunger, thirst, or some other drive is placed in a compartment at one end of a long box. At the other end is food, water, or some other incentive. Between animal and incentive lies a narrow passage, the floor of which is an electric grid which gives a shock when touched. The stronger an animal's drive, the more shock it can take.

Warden's most famous experiment compared the relative strength of five major drives in the white rat. A hungry or thirsty

rat was allowed to cross the grid and nibble food or sip water, briefly. Then it was put back in the end compartment. Each time it crossed the grid it was put back. The strength of its drive was measured by the number of times it crossed the grid in twenty minutes. With maximum drive operating, Warden found these averages, using many rats:

DRIVE	INCENTIVE	NUMBER OF CROSSINGS
<i>Maternal</i>	Litter of young	22.4
<i>Thirst</i>	Water	20.4
<i>Hunger</i>	Food	18.2
<i>Sex</i>	Rat of other sex	13.8
<i>Exploratory</i>	New location	6.0

Maternal, thirst, and hunger drives differ little in strength, but they are definitely stronger than the sex and exploratory drives.

Interested in human motivation, FLOYD H. ALLPORT, of Syracuse University, in 1924 listed six "prepotent reflexes," or basic inherited activities of humans. They are: starting and withdrawing, rejecting, struggling, hunger reactions, "sensitive zone" reactions aroused in tickling, and sex reactions. The first four operate from birth. The sensitive zone reaction appears in early infancy, sex activities appear much later. These six primary activities, Allport said, can be modified and diversified greatly through learning. Thus, rejecting leads to cleanliness, struggling to pugnacity, sex to maternal and paternal habits. Cleanliness or pugnacity is not an "instinct" but a "social habit" acquired through individual experience.

Motives

The word "drives" soon appeared inadequate to describe all of human motivation. Human beings are more complex than animals. They have physiological urges, but they have other powerful urges too that seem to spring from social sources. For instance, many persons seem driven by a desire to acquire an

hold property or other possessions. Their urge is deep-rooted. Yet its absence in other persons, in fact its absence in whole cultures like the Kwakiutl Indians of British Columbia as shown by the anthropologist Franz Boas, indicates that it is acquired from the cultural pattern.

To include these social urges as well as the physiological drives found in human beings, the term "motive" came to be used.

WILLIAM I. THOMAS, a sociologist, prepared one of the best known comprehensive short lists of human motives. In the normal adult, said Thomas, are four fundamental motives: desire for security, for response, for recognition, and for new experience. To get security we provide bodily necessities, work at jobs, and acquire property. To satisfy our response needs, we seek social and sexual contacts. For recognition we strive for prestige, admiration, the respect of our social group. For new experiences we lean toward adventure or any change from routine. All normal persons in our culture have these four motives, though seldom in the same degree. The well-adjusted person satisfies reasonably well each of his fundamental wishes.

LAURANCE F. SHAFFER lists human motives thus: subsistence, mastery, social approval, conformity, sex, and mixed motives. Shaffer, like Thomas, is uncertain how much physiological drives determine the more complex motives found in adults. With security and sex, organic factors figure prominently. With others, social conditioning dominates.

How can the relative strength of human motives be estimated? Obviously Warden's ingenious laboratory box with its electric shock can not be used for human beings, though the idea is interesting to contemplate. Other methods have been tried. DANIEL STARCH asked 74 men and women to rate the importance of several dozen motives in determining their actions from day to day. These were rated strongest: hunger, love of offspring, health, sex attraction, ambition, pleasure, bodily comfort, possession, ap-

proval by others. While evaluating one's own motives opens infinite possibilities for error, Starch's results roughly parallel those of Thomas and Shaffer.

Trying for more objective data on the relative strength of human motives, EDWARD L. THORNDIKE discovered how much money Americans spend annually for clothes, food, life insurance, shelter, and the like. Several impartial judges estimated which desires the various expenditures seemed to satisfy. Of 24 desires the following rated strongest: hunger, security, protection against the elements, approval of others, and welfare of others.

Unhappily psychologists' lists of motives do not agree very well, largely because motives are hard to identify and measure. On the other hand, certain motives appear on most lists. ALBERT T. POFFENBERGER, after surveying several studies, concludes that the following list of desires is "most likely to be acceptable to the majority of authorities": sensory stimulation (sights, sounds, contacts, and the like), exploration and manipulation, approval, self-assertion or domination, giving and receiving affection, comfort (including security and protection), and association with persons of one's own kind.

Incentives

Our drives and motives are always with us. We can no more shake free from the regular recurrence of hunger or thirst than we can escape death or taxes. On the other hand, our motivation can be affected considerably by a number of temporary factors. Incentives like reward and punishment, or praise and reproof, are notable examples.

The magic effect of a chocolate bar promised to fifth-graders working multiplication problems was shown by CLARENCE J. LEUBA. For a week he gave them ten-minute exercises in multiplying without reward. Then he promised each a chocolate bar for improving a certain amount. Performance shot up 52%. Combining incentives (rivalry, praise, and candy) he got a 62%

improvement, compared with a group of children not similarly motivated.

Rats require a reward to learn a maze, EDWARD C. TOLMAN and associates found. A hungry rat learns little or nothing about finding its way through a maze until a food reward is produced. If the reward is given at the end of several trials, then removed, learning ceases and the rat may lose its previous progress.

Punishing kittens with an electric shock for erring in a problem box, Robert M. Yerkes and John D. Dodson discovered that with easy tasks learning improves in proportion to strength of punishment. With difficult problems only mild punishment brings improvement. Severe shocks disorganize behavior.

The same principle holds for blindfolded human beings learning to push a stylus through a maze, according to James Vaughn and Charles M. Diserens. Slight electric shocks step up progress, but bigger shocks disrupt rather than hasten learning.

Albert M. Johanson compared the effects of two incentives—knowledge of results, and punishment—on speed of reaction time. Subjects pressed a key as fast as possible on hearing a signal. When told their previous reaction times, they speeded up 6%. When given electric shocks for slowing down, they improved 15%.

Further proof that motivation increases when subjects know how they are getting along comes from WILLIAM F. BOOK. With four different tasks of the intelligence test variety, subjects who knew how they were doing gained faster and more steadily than those who did not. When not told their results, the first group slumped badly. Book concluded that the “will to learn” is stimulated a good deal by telling a student his progress.

How praise and reproof affect our learning is demonstrated by ELIZABETH HURLOCK in an important experiment. She chose four groups of school children, equal in arithmetic ability. One group was praised before the class for doing excellent work. The second group was reproved severely for bad performance. The

third was ignored, though it heard the other groups praised and reproved. In another room the fourth group heard nothing. Striking results appeared. Both the praised and reproved groups immediately improved 35% to 40%. The ignored group improved only half as much. Later the praised group climbed to a 79% improvement. The reproved and ignored groups fell off in performance. The isolated group lost slightly but not significantly throughout. Dr. Hurlock concluded that praise and reproof motivate about equally in the short run, but that over longer periods praise brings better results.

Industrialists, quick to see that whatever psychologists learned about incentive had practical value for them, launched experiments in their own plants. Bonuses for improvement, Harry D. Kitson found, upped by 35% in twenty weeks the output of hand compositors in a print shop.

The English industrial psychologist STANLEY WYATT compared three wage plans. For nine weeks girls received a fixed wage. Then for a time a bonus system was used. Finally a piece rate was adopted. The bonus increased output more than 50% over the fixed wage production. An extra 40% rise accompanied the piece rate system.

Financial incentives are not always stronger than other factors. Wyatt found that when workers did disagreeable jobs the bonus or piece rate failed to increase output. With interesting jobs, on the other hand, improvement soared as much as 200%.

Probably the most extensive industrial motivation study was made for Western Electric by several Harvard University experts, including ELTON MAYO and T. N. WHITEHEAD. For several years six girls assembling telephone relays were studied under various types of work periods, rest pauses, atmospheric conditions, and wage plans. Curiously enough, output in general rose steadily, even when unfavorable conditions were introduced—a result that surprised the investigators. Both the long run improvement and most of the temporary lags or spurts turned out

to result not from physical factors like hours and wages, but from social factors like the girls' attitudes toward each other. Approval, antagonism, or indifference directly affected production. A feeling of importance at being selected for the study, a sense of responsibility for the project, and growing congeniality among themselves caused the general improvement. In other words, human relationships motivated the workers more strongly than financial incentives or good working conditions.

CHAPTER IX

Emotions

DARWIN JAMES LANGE
WUNDT TITCHENER LANGFELD BORING WELLS
LANDIS SHERMAN SHERRINGTON CANNON BENUSSI
JUNG MARSTON KEELER GOODENOUGH KLINEBERG
BRIDGES BLATZ WATSON JONES



Is an emotion physical or mental or both? To what extent do facial expressions and gestures reveal emotional states? What happens to our bodily functions when we experience emotion? How do our ductless glands affect emotions? What is a lie detector? How does it work? Does it really detect guilt? Do emotions just develop, or do we learn them? How can we get rid of fears?

CHARLES DARWIN published a little book in 1872 entitled *Expression of the Emotions in Man and Animals*. He said that facial expressions and postural movements trace back to once useful actions. Showing the teeth in anger, for example, is a relic of primitive combat when man fought his battles by clawing and biting. Closing the mouth firmly in determination comes from physical effort and straining, which with our ancestors generally accompanied determination. Social tradition plays a part too; clasping the hands in supplication originated in the early custom of raising the hands to be bound.

Darwin did the first experiment on emotions. He showed pictures of posed emotional expressions to several judges. They disagreed surprisingly in identifying the emotions.

Differing with Darwin, a German anatomist named THEODOR PIDERIT believed that facial expressions actually help or hinder reception of stimuli by the sense organs. Wrinkling the nose helps shut out bad smells. Pressing tongue and lips against the teeth gives maximum sweet taste. Dropping the tongue from the roof of the mouth helps avoid bitter tastes. We make these grimaces when smells or tastes are recalled though actually absent. With unpleasant thoughts the mouth screws up as though avoiding bitter tastes.

A puzzling aspect of emotion is the relation between our feeling and our accompanying physiological changes, like facial expression, heart beat, or breathing rate. Formerly it was assumed that when we feel afraid the fear causes the heart to pound and we then run away.

WILLIAM JAMES and a Danish physiologist, KARL G. LANGE, independently advanced an interpretation later called the James-Lange theory. It reversed the old idea. Bodily changes cause emotion, it said. If there are no changes, there is no emotion. Instead of the sequence, "man sees bear, feels frightened, runs away," James and Lange offered this sequence: "man sees bear, starts to run, and as a result feels afraid." Though backed by little real proof, the theory, having a physiological basis, seemed at the time more scientific than others.

WILHELM WUNDT objected to the traditional classification of emotions into pleasant or unpleasant. He proposed a "tridimensional theory." Every feeling, he said, has three aspects: pleasantness or unpleasantness, excitement or quiet, and tension or relaxation. A feeling may be pleasant, relaxed, and quiet, or it may be unpleasant, excited, and tense. If none of these six experiences is present, there is no emotion.

Experimenting on the problem, EDWARD B. TITCHENER, who

had studied with Wundt, found that his subjects often had difficulty in identifying these three "dimensions" of feeling, in distinguishing between excitement and tension, for example, or between quiet and pleasantness. The only real dimension, Titchener found, was pleasant-unpleasant. His research led him to suspect that experiences like "tenseness" or "excitement" really are organic or muscular sensations, not feelings.

Expressing Emotions

We judge others' emotions largely by their facial expressions and their gestures. It seems easy to recognize anger in a person's face, or astonishment; yet experiments show that we are often mistaken.

HERBERT S. LANGFELD of Princeton University asked subjects to identify emotions portrayed in 105 photographs posed by an actor. The best subjects judged 58% correctly, the worst, 17%. Correctness meant agreement with the actor's intended emotion. Langfeld found that his subjects not only judged emotions wrongly; they were uncertain of their judgments, and were easy to lead astray by suggestion.

EDWIN G. BORING and Titchener also proved that subjects are suggestible when judging facial expressions. They prepared different expressions of the mouth, eyes, nose, and brow that could be combined various ways into profiles. Practically all of the composite faces, when shown to subjects, were judged to portray actual emotional states, even when the parts, arbitrarily assembled, were inconsistent.

Whether the eyes or mouth express more emotion was studied by Knight Dunlap. He cut portrait photographs in half, crosswise, then combined the parts so that the eyes of a face expressing pain, let us say, were put with the mouth of the same face showing pleasure. Contrary to a general, perhaps literary, notion that eyes are "mirrors of the soul," subjects proved more influenced by mouths than by eyes in judging emotions.

A woman psychologist named Antoinette Feleky asked a hundred persons to identify the emotions in 86 pictures, posed by an actress. Judgments varied. The highest agreement was 52%. One picture was identified in 39 different ways. However, Robert S. Woodworth later showed that the judges were not in great disagreement. Although only 52% judged "surprise" correctly, another 31% called it "wonder," "astonishment," or "amazement," synonymous terms. By grouping similar poses and judgments, Woodworth found 60 or more per cent agreement on happiness, surprise, fear, anger, disgust, and contempt.

To avoid the chance that posed pictures fail to express genuine emotions, CARNEY LANDIS photographed faces in real emotional situations. He shot off guns unexpectedly, gave electric shocks, showed bawdy pictures, made subjects decapitate a rat with a blunt knife, or watch the decapitation.

His pictures revealed no characteristic facial expression for pain, surprise, disgust, or other emotional states. The only response common to many persons was a smile. The same subject showed similar expressions in various situations, but Landis proved conclusively that no specific facial reaction characterizes a given emotional state.

Studying vocal expression, MANDEL SHERMAN showed that in newborn babies cries of pain, hunger, fear, and anger can not be distinguished, contrary to what young parents are told. Older children and adults tend to reveal their stronger emotions, like excitement or anger, by speaking loudly in high-pitched tones.

Hand gestures seem more specifically expressive. Leonard Carmichael and associates had an actress portray emotions solely by movements of the hands. College students, interpreting them, agreed fairly well. Imitating the gesture and trying to think of situations wherein it occurred helped them name the expression, they said.

Physiological Aspects

Ingenious experimental operations on animals' nervous systems, performed about 1900, discredited the James-Lange theory that emotion follows physiological changes.

SIR CHARLES SHERRINGTON cut the spinal cords of several dogs just below the brain. They then had no sensations from the viscera or skeletal muscles. According to the James-Lange theory the animals should not experience emotion because the bodily basis was removed. Yet the dogs continued to show anger and affection. They also revealed disgust, rejecting unsavory meat. Though the evidence is inconclusive because we can not know how a dog really feels, the outward expression resembled true emotion.

Harvard's WALTER B. CANNON revealed the relation between emotions and the autonomic nervous system, which regulates circulation, breathing, digestion, and glandular action. He proved that the sympathetic or central division of the autonomic system controls bodily changes occurring in strong emotions like fear and rage. It speeds up blood pressure, heart beat, and breathing rate, and inhibits digestion.

Cannon operated on cats, severing the sympathetic from the central nervous system. This eliminated visceral sensations during emotional states. Yet he found, like Sherrington, that the cats showed all the signs of genuine emotion when given an electric shock or approached by a barking dog.

Cannon showed also the adrenal gland's importance in emotion. During intense pain, fear, or anger, the adrenal hormone is injected into the blood stream. This hormone releases sugar from the liver into the blood stream, increasing muscular energy. It counteracts muscular fatigue, raises blood pressure and heart rate. It supplies more blood to arm and leg muscles. It also hastens blood clotting in case abrasions occur. These functions, said Cannon, help deal effectively with emergencies. They have sur-

vival value in situations that endanger existence, because they prepare us for more intense effort. Sometimes a person chased by an angry bull finds he has scrambled over a high fence that he could not have scaled without the help of his adrenal hormone.

Studying brain action Cannon found that a lower brain center, the thalamus, controls emotions. Intact, the thalamus permits normal emotional reactions. If areas near the thalamus are cut away, a more intense emotion generally occurs. This suggests that other brain centers inhibit the thalamus. Cannon worked out a "thalamic theory" of emotions as an alternative to the James-Lange theory. The thalamus, he said, sends impulses directly to the cortex and to the muscles, and to the viscera by way of the autonomic nervous system. The feeling of emotion does not cause bodily changes, nor is it caused by them. But it is intensified by pronounced, prolonged muscular and visceral activities. Cannon's theory, now generally accepted, assigns emotions to a brain function instead of to widespread bodily changes.

Breathing Changes

When we have an emotion, our breathing changes. Fiction writers often refer to this phenomenon. Men and women are said to "gasp with amazement," "sigh with relief," "catch the breath in fear." Early this century psychologists began actually to measure breathing changes.

GUSTAV STÖRRING, a German psychologist, suggested that noting the ratio between time taken for inspiration and for expiration would show the changes quantitatively. The pneumograph is used for this. Usually it consists of an air-filled rubber tube strapped about the chest, with an outlet at one end connected to a recording needle. The needle, moving up and down as the subject breathes, records on smoked paper a wavy line showing inspiration and expiration.

Dr. Feleky found a low ratio of inspiration to expiration during laughter (about .30), when inspiration is fast and expira-

tion slow. On the other hand, she found it very high in wonder or surprise, inspiration taking two or three times as long as expiration. With fear, WILLIAM E. BLATZ discovered the ratio rose from normal (about .70) to 3.00 or 4.00.

In 1914 VITTORIS BENUSSI, an outstanding Italian psychologist, proved that this ratio can be used to detect lying. He had almost 100% success in telling whether or not his subjects were lying, whereas persons trying to judge by observing the subject did no better than if merely guessing. The respiratory ratio decreased after truth telling and increased after lying. This happens because a liar has a harder job making his story hang together, Benussi said. No other investigator has detected lying so successfully by breathing changes, though the pneumograph still is used as a part of most lie-detection systems.

Blood Pressure

Of circulatory changes caused by emotion, blood pressure is the best indicator. It is measured by the sphygmomanometer, an instrument used by doctors. William E. Blatz placed subjects in a special chair, which unexpectedly fell backwards. Fear and surprise raised their blood pressure about 20 beats a minute. Later, blood pressure rose again when subjects returned to the chair anticipating the fall. Landis found that a combination of hunger, fatigue, and pain raises blood pressure.

WILLIAM M. MARSTON, physiological and consulting psychologist, studied blood pressure changes of ten men and ten women in several situations. Conversation with a new acquaintance of the opposite sex shot blood pressure up twice as much as did reading a story or newspaper, he discovered. Telling one's actions for the past day raised it somewhat, as did cross-examination on the same topic. Women's blood pressure increased twice as much as men's, though wide individual differences appeared.

Marston tried out blood pressure as an index of deception. Ten "witnesses," testifying before a jury, were instructed to tell

the truth part of the time and to lie part of the time. Blood pressure changes enabled Marston to distinguish truth from falsehood in 96% of the cases. The jury relying on observation alone judged no better than if they had judged by chance (50%). Blood pressure increased slightly even when subjects told the truth; it went up three times as much when they lied. The rise Marston attributed to emotional excitement.

The Psychogalvanic Response

Several nineteenth century physiologists noted electric phenomena of the skin. J. Tarchanoff discovered a weak current passing between electrodes placed at two points on the skin. He measured it by a delicate galvanometer. The amount of current, he found, varies with mental activity, due to changing action of the sweat glands.

This change in the skin's electrical conductivity is called the psychogalvanic reflex (PGR), galvanic skin response, or electrodermal response.

CARL G. JUNG and an associate used the skin response to reveal personality "complexes." They read off, one at a time, a list of words asking the subject to respond to each by giving the first word that came to mind. A galvanometer was applied to the subject's hand during the word association test. When a word aroused emotion, the instrument registered a higher current. Analyzing the responses, Jung detected emotional tensions like love affairs, guilt or inferiority feelings, or thoughts of suicide.

To test whether skin responses really measure emotion, FREDERIC L. WELLS and an associate gave subjects emotion-arousing stimulus words and noted the amount of current recorded by the galvanometer. The subjects then rated the emotional value of each word. In general the skin response corresponded closely to the estimated emotional intensity. Recently Carney Landis and William A. Hunt proved that the galvanic response is greatest in states of "tension," startle, surprise, fear, and confusion.

Lie Detection

In 1921 an enterprising young police officer, JOHN A. LARSON, devised a "lie detector," based on Benussi's and Marston's experiments. It recorded pulse rate, blood pressure, and breathing changes.

A few years later LEONARDE KEELER, of Northwestern University's crime detection laboratory, brought out an instrument he called the "polygraph." It records changes in blood pressure, respiration, and galvanic skin response.

Larson's apparatus and technique, improved by Keeler, helps detect guilt in many legal cases. It requires expert handling and a quiet atmosphere. The subject is told that the instrument will show whether or not he answers questions truthfully; if he tells the truth he has nothing to fear. This relieves tension in an innocent person, intensifies it in a guilty one, which makes detection easier.

First several neutral questions are asked: Is your name John Doe? Did you drink coffee for breakfast? At intervals among irrelevant items come the key questions: Did you shoot Richard Roe? Do you know who shot him? Almost always a guilty person shows greater upset than an innocent person at crucial questions, compared with his reaction to irrelevant ones.

Good as it is, the method occasionally fails. Innocent persons also can be upset by key questions. Keeler and FRED E. INBAU improved lie detection by a so-called "peak of tension" test. It works this way. Suppose several suspects are picked up after the theft of two diamond rings from an Oak Street house, which was entered through a cellar window about eleven o'clock Tuesday night.

Six or eight street names are listed, like Walnut, Chestnut, or Pine. Oak Street appears about midway in the list. Each suspect, shown the list, is told he will be asked whether he knows about a robbery on any of these streets. Then the test proceeds. To each

question the suspect answers no. Typically the guilty person's blood pressure rises gradually to the key words, Oak Street, then declines. Breathing usually slows perceptibly at the key question. If only one subject shows peaks of tension at all key items—Oak Street, cellar window, diamond rings—his guilt is apparent.

Often the lie detector induces guilty persons to confess. Innocent persons welcome the test, confident it will reveal their innocence.

Keeler believes the lie detector about 80% accurate. Mental defectives, psychopaths, and persons with abnormal physiological reactions are hard to test. Almost always they can be identified, however, and the experimenter simply reports that a test is useless in such cases. When a test is given and inconclusive results occur, they are reported to the court, which then decides the case on the basis of other evidence.

Appellate courts do not recognize lie detector evidence, according to a recent survey made by Inbau. Suspects in trial court cases are often referred for the test, when both prosecuting and defense attorneys agree to it.

Business firms are beginning to make use of guilt detection methods. To test the honesty of their employees some companies send their whole personnel to a guilt detection laboratory. In one instance reported by Keeler, a big majority admitted stealing, from costly items right down to stamps, pencils, and stationery. Or, if they denied stealing, they were caught by the detector. No punishment was given, but the employees were told that another test would be given during the following year. On the re-test only 2% or 3% were found guilty; they were discharged.

How Emotions Develop

In concluding, we turn to the important question of how emotions originate. Do a child's emotions develop as he grows up, or does he learn them? Here again the old maturation or training question arises.

K. M. B. BRIDGES showed how emotional reactions develop from simple excitement in a newborn baby to a dozen or more distinct reactions in the 2-year-old, including fear, disgust, anger, jealousy, delight, and affection.

William E. Blatz and a colleague noted the ages at which new behavior appears during emotional states. Up to 4 months the baby cries, struggles, gives a start. Between 4 and 8 months he resists, holds out his arms and throws things. Later he stiffens and clings. Between 1 and 2 years of age he runs away, hides his face, says no, and slumps.

An interesting case supporting maturation is described by FLORENCE GOODENOUGH. A 10-year-old girl, deaf and blind from infancy, was found to express fear, anger, disgust, and delight like normal children. As this child could not have learned from seeing or hearing others, Goodenough believes the case argues strongly for maturation.

To show how learning affects emotional reactions JOHN B. WATSON gave a white rat to a year-old child having no fear of small animals. As the child reached for it, a loud noise was made behind his head. He drew back, startled. This was repeated several times. After conditioning, the child cried at seeing the rat alone. The acquired fear spread to similar objects, like a rabbit, dog, and fur coat. In accounting for fears and other emotional reactions, Watson thereafter stressed experience, especially in childhood.

A few years after Watson's experiment, MARY COVER JONES showed that fears can be eliminated by conditioning. While a child who feared rabbits was eating, she brought a caged rabbit into the room and kept it some distance away. During subsequent meals the rabbit was brought closer and closer until the youngster ventured to touch it, eventually to fondle it. The procedure was very gradual. A too hasty approach might have brought back all the old fear, indeed might have transferred it to the food instead of removing it from the rabbit.

Dr. Jones found that most methods recommended to eliminate fears do not work. Fears, she learned, do not "die out" with time, nor can they be argued away. Becoming familiar with a feared object by constant exposure to it may reduce fear, but even this seldom entirely removes the fear. Repressing fear because other children ridicule it only intensifies emotional reaction, she discovered.

A method called "social imitation," in which a child having a fear is placed with others not having the fear, sometimes is successful. Their reassurance helps him overcome his fright. Social imitation and reconditioning, mainly the latter, are the most effective ways of eliminating fear.

How we express our emotions, as well as what arouses them, depends a good deal on our training and experience. OTTO KLINEBERG presents interesting anthropological evidence of this. The Chinese are "poker faced" largely because they are taught restraint. Chinese boys and girls learn not to laugh boisterously or show their anger. Yet in different environments with different culture patterns, like Hawaii, Chinese persons express their emotions more like westerners.

Many emotional expressions differ the world over. In some societies the kiss as a sign of affection is unknown; instead, two persons may rub noses, touch the nose to the other's cheek, or touch the other's nose with the index finger. Weeping often is part of tribal ceremonies, yet once the ceremony ends, laughter and gaiety follow quite naturally. Certain peoples vent their anger in queer traditional ways; they break up their possessions or set fire to their own houses. Laughter, however, seems the universal expression of high spirits. Klineberg concludes that emotional expression, like language, must be at least partially learned.

CHAPTER X

Measuring Personality

HIPPOCRATES THEOPHRASTUS BAIN NIETZSCHE
JAMES JUNG SPRANGER STERN ALLPORT VERNON
WOODWORTH BERNREUTER GUILFORD HARTSHORNE
MAY DOWNEY FRANK RORSCHACH STRONG

What is personality? Do personality types exist? What are personality traits? How are they measured? Can personality be judged by performance? How do the new "projective methods" differ from other kinds of tests? What is the chief value of interest tests?

EACH OF US HAS A PERSONALITY unique and distinct from every other personality. By personality we mean the sum total of our ways of behaving, especially toward other persons.

Personality is not an elusive quality which radiates from certain fortunate persons and not from others. It is unbelievably complex, the result of a lifetime of experiences and influences. Superficial changes, like affecting a genial smile, adopting a new hair-do, or cultivating poise, fail to affect our true personalities, which go much deeper.

Until recent times the meaning of personality was not clearly defined. The word itself probably derived from the Latin *persona*, a mask through which an actor spoke his lines. In this sense it referred to external appearance, or the role one plays.

But the word "personality" was used in many ways. Harvard's

Gordon W. Allport found fifty different usages, with theological, philosophical, legal, and psychological meanings. Allport considers personality a person's pattern of habits, attitudes, and traits that determine his adjustment to his environment.

Early Type Theories

Almost everyone who has ever pondered the problem of personality has sooner or later classified people into types, generally on the basis of certain physical characteristics.

The first classification into types was the work of HIPPOCRATES, famous Greek physician of the fifth century B.C. Human temperaments, he said, are divided into the *sanguine*, the *melancholic*, the *choleric*, and the *phlegmatic*, according to the dominance of the following bodily "humors": red blood, black bile, yellow bile, or phlegm respectively. This assigning of a bodily basis for personality has a very modern sound, and has an echo in recent attempts to explain personality through study of the endocrine glands.

THEOPHRASTUS, a pupil of Aristotle, founded "characterology," a literary description of personality types. He described, skillfully and with striking examples of behavior, thirty extreme types of persons, such as the penurious man, the boor, the flatterer, or the loquacious man.

Two thousand years later character writing was resumed by the Frenchman JEAN DE LA BRUYÈRE and by numerous English writers, among them Ben Jonson, Joseph Addison, Richard Steele, and Samuel Butler. Character writers have generally shown much psychological insight, though they seldom have probed deep enough to uncover the real origins of behavior.

Physiognomy

Physiognomy interprets personality from physical features, particularly the face. It began before Aristotle's time and revived with the Renaissance.

Johann Lavater, the best known physiognomist, wrote late in the eighteenth century. He described the psychological significance of height of forehead, shape of nose or jaw, and other features. Though for the most part unscientific, he maintained that a person's features are consistent with each other. GORDON W. ALLPORT and PHILIP E. VERNON show some evidence for this theory by demonstrating a consistency between such expressive features as voice and handwriting.

More modern writers have claimed that type of facial features reveals personality. The Italian criminologist, Cesare Lombroso, said that criminals have prominent cheekbones and jaw, oblique eyes, receding forehead, and large ears. Skeptical of this, the English scientists Charles Goring and Karl Pearson measured features of 3,000 criminals and compared results with measurements of college students and army men. No differences were found between the physiognomies of criminals and of Oxford or Cambridge men. Havelock Ellis, among others, claimed that skin and hair coloring tie up with personality traits. Studying portraits he reported that thinkers and writers are brunette while men of action and ambition are blond.

In 1930 Donald G. Paterson published *Physique and Intellect*, which summarizes the case against physiognomy. Absolutely no evidence exists that shape of nose, mouth or ears, height of forehead, contour of skull, or any other feature has anything to do with personality. A cheery or sad facial expression may reveal a psychological state, but this is very different from what the physiognomists claim. As Gordon Allport says, our muscles—including those of the face—reflect life experiences to some extent, but our bony structures do not.

Later Type Theories

The nineteenth century produced several interesting personality type theories. ALEXANDER BAIN, impressed with Plato's threefold division of the soul, suggested that men's energies go

chiefly into intellectual, emotional, or volitional channels. This theory survives in the classification of people into intellectual, artistic, and practical types.

FRIEDRICH NIETZSCHE proposed two contrasting philosophies of life, the Apollonian and Dionysian. The Apollonian signifies calm, reason, restraining the passions, and, in general, living by the rule of "nothing to excess." In the Dionysian way the senses and impulses dominate, free from reason's restraint.

WILLIAM JAMES suggested that people can be divided into the "tender minded" and the "tough minded," according to whether they are influenced more by ideas or by facts. Similarly WILHELM STERN divided them into subjective and objective.

Probably the best known type theory is CARL G. JUNG's introversion-extroversion. The introvert is preoccupied with his own impressions and psychological processes; for him subjective factors dominate. The extrovert leans toward objective facts, and activities in the outside world. Outward relations, not subjective values, are important. Jung did not suggest that people should be classified either as introverts or extroverts. Unfortunately this often is assumed. He said that everyone has tendencies toward both introversion and extroversion, though one generally predominates. In fact, the same person may alternate between introversion and extroversion.

One other type theory holds considerable interest. EDOUARD SPRANGER, a German psychologist, classified people according to what values they believed most important. He noted six types: theoretical, economic, political, esthetic, social, and religious. He admitted that people do not fit exclusively into one or another category. Allport and Vernon devised a test, based on Spranger's six values. Their results showed that persons in various arts, professions, or in education do lean toward the values predominant in their own fields. Engineering and business students scored highest in economic values; language and literature students in esthetic values; persons preparing for the ministry in religious

values. Men ranked higher in theoretical, economic, and political values, women in esthetic, social, and religious values. The differences in tendency were not large, however. People generally do not stress any one value to the exclusion of others.

Psychologists have learned the pitfalls of type theories. Mainly the danger lies in our almost unfailing tendency to pigeonhole everybody in one category or another. Though a theory may be issued with all proper warnings by its author, sooner or later it becomes an either-or proposition—either you fit in one category or you fit in the other, with no middle ground. This usually happens with Jung's introvert-extrovert theory.

Actually most people are neither introverts nor extroverts. Psychologists prove this. Edna Heidbreder gave 200 college students an introversion-extroversion questionnaire. Few revealed themselves introverts or extroverts. Most were in-between, or "ambivert," as the middle ground is called. Theodore Newcomb, observing boys in camp, found little consistency in their behavior. A boy who seemed introverted at one time seemed equally extroverted at another, and vice versa.

Psychologists now regard types as extreme forms of personality traits. A trait merely is some aspect of behavior wherein persons differ. A tendency toward maladjustment varies in degree from temporary minor peculiarities, which most of us show, to complete insanity. Gordon and Floyd Allport found a few persons consistently "dominant," a few consistently "submissive," but most not definitely one or the other.

Personality Questionnaires

Personality frequently is measured by questionnaires. The method began when ROBERT S. WOODWORTH devised a "Personal Data Sheet" in 1918 to determine emotional instability or neurotic tendency among soldiers. It had 116 questions, each answered by yes or no. Woodworth chose items relating to various physical symptoms, fears, worries, feelings, and attitudes known

to indicate mental and nervous disorders. Some of the questions are: Do you usually feel well and strong? Do you have nightmares? Have you often fainted away? Does liquor make you quarrelsome? Are you troubled with the idea that people are watching you on the street? Did you ever have the habit of wetting the bed? Did you ever have a nervous breakdown?

Despite drawbacks this type of questionnaire gives a rough measure of personality traits. Probably the best known similar test is ROBERT G. BERNREUTER'S "Personality Inventory." It has 125 questions, answered by encircling yes, no, or a question mark. By scoring the answers four ways, Bernreuter measured neurotic tendency, self-sufficiency, introversion, extroversion, and dominance-submission. For example, the question, Do athletics interest you more than intellectual affairs? relates significantly to introversion-extroversion. The question, Are people sometimes successful in taking advantage of you? relates most closely to dominance-submission.

John C. Flanagan, specialist in mental measurement, analyzed Bernreuter's test statistically and found self-confidence and sociability its two most important components. With these added to the original four, the Bernreuter inventory now measures six personality traits.

What all the basic personality traits are, psychologists have not yet determined. Analyzing several tests JOY PAUL GUILFORD and RUTH B. GUILFORD conclude that some basic traits are social introversion (shyness, withdrawal from social contacts), thinking introversion (meditation, self-analysis), masculinity or dominance, emotionality (instability, fluctuations in mood), depression (including feelings of unworthiness and guilt), and "rhythymia" (a happy-go-lucky, carefree, impulsive disposition).

A variation of the personality questionnaire is Sidney L. Pressey's "cross-out test" to measure emotionality. On a long list of words the subject is asked to cross out those unpleasant to him;

on another list, those he considers wrong or unethical; on another, items about which he worries.

Though interesting information about a person's emotions is revealed, the test is not used generally to measure personality.

Performance Tests

Obviously persons may answer questionnaires wrongly or dishonestly, and there lies a serious weakness in this kind of test. To avoid such errors, performance and behavior tests often are used.

Among the earliest performance tests was JUNE E. DOWNEY'S "will temperament" test, based mainly on handwriting. It purported to measure persistence, decisiveness, speed, flexibility, and other traits. A subject writes "United States of America" at his usual speed, then writes it as fast as he can. The difference between his two speeds indicates freedom from inhibition. His ability to change writing speed shows how flexible his personality is. His success in writing several words on a line slightly over an inch long demonstrates his coordination of impulses.

Dr. Downey's test was popular during the 1920's. But it proved a poor measure of personality, chiefly because psychologists showed that no one type of expression like handwriting indicates personality trends adequately.

On the other hand, Allport and Vernon show that handwriting and other expressive behavior like walking and reading speed, or ability to estimate areas and distances, show rather consistent personality patterns. Yet there is no evidence that any one expressive movement, or in fact all of them together, relate very closely to personality traits.

Though certain experiments show that inexperienced persons can do better than guessing in matching handwriting specimens with personality sketches of their writers, and experts have even better success, the results still fall closer to chance than to perfection, as Allport and Vernon point out. In the last analysis, expressive

movements and handwriting really fail to measure personality.

A clever plan to estimate introversion-extroversion was worked out by LESLIE R. MARSTON. A child was brought into a room where the experimenter held a toy in his hand. If the child fled or required urging to play with the toy, he was called introverted. If he approached promptly and began to play, he was considered extroverted. His persistence in opening a puzzle box and his patience in waiting for a promised toy were tested. Marston also took children to a museum, noting their tendency to become absorbed in exhibits or to move rapidly from one exhibit to another without sustained interest. He found fair correlation between behavior in these situations and the children's introversion-extroversion ratings by teachers. Though interesting, the method offers too many practical difficulties to be used very generally.

The best performance study of personality is an honesty test by HUGH HARTSHORNE and MARK A. MAY. They gave children many natural situations wherein they easily could cheat. They could copy from a neighbor's paper, change answers when scoring their own tests, "peep" in a blindfold game. Other situations tested stealing and lying impulses.

A general trait of honesty or dishonesty does not exist, Hartshorne and May found. Almost all children were dishonest in at least one situation, but many cheaters did not steal, and many who lied did not cheat. A child's Sunday school attendance had negligible effect on his honesty. Older children cheated more than young ones, the retarded more than intelligent ones. Children who came from good homes and who respected or admired their teachers were more honest. But in general, honesty or dishonesty depended on a specific situation, not on a consistent personality trait.

Recently psychologists and psychiatrists have become interested in new performance tests called "projective techniques." According to LAWRENCE K. FRANK, vice president of the Macy Foundation, an early sponsor, these new methods give a person

a chance to express his "private world of meanings, significances, patterns, and feelings." Standardized personality tests like questionnaires tell little about active and dynamic individual personality, Frank says. When a person tells what a cloud looks like to him, or gives his own interpretation of a picture containing people, he "projects" into it something of his own personality. If he interprets several items in the same general way, this may reveal important trends of thinking, attitude, interest, and emotion.

The "inkblot test" prepared by HERMANN RORSCHACH, a Swiss psychiatrist, is the best known projective technique. It consists of ten cards, each containing a rather elaborate inkblot. Five blots are in color, five in gray and black. Subjects study



A TYPICAL INKBLOT

one blot at a time and tell what each resembles. They can ruminate as long as they like over each card. The examiner records their responses; then shows the cards a second time asking the subjects to elaborate ambiguous interpretations and explain which parts of the inkblots led to their responses.

Results are scored by three main criteria. Do subjects react to the whole blot, to a part, or to a small detail? Do their responses involve movement, form, color, or the three combined, and is the form clear or blurred? Do subjects see human or animal figures, or chiefly inanimate objects? The complete scoring is quite complex, involving many factors beyond mere counting of responses.

Seeing whole figures indicates high intelligence and ability to synthesize. A predominance of forms in motion, especially of human forms, signifies vivid imagination. Great response to color means impulsiveness, if not emotional instability. Seeing mostly animals, and giving unoriginal responses in general, suggest lower intelligence and stereotyped thinking. On the other hand, noting small unusual details indicates introversion and possible emotional conflicts. Noting third-dimensional shading effects signifies anxiety. A preponderance of responses determined by shape or form means good control, harmony between the intellectual and emotional aspects of personality.

Psychological opinion is divided about the Rorschach test and other projective techniques. Henry A. Murray of Harvard, himself the creator of several new projective methods, says their validity is demonstrated with children, but some doubts remain about adults. Gordon Allport questions whether projective tests necessarily reveal the deeper strata of personality, as they are alleged to do. Henry E. Garrett expresses the view of many psychologists when he says that the Rorschach test lacks objectivity, and well-established norms, that its interpretation is intuitive and without experimental verification. Robert S. Woodworth declares the real test of validity "is to size up the subject's personality entirely from the Rorschach results and then to compare your finding with what is known of the individual from other sources." Woodworth agrees, as does Garrett, that in clinical work the test helps diagnose personality difficulties of persons with mental and nervous diseases, of delinquents, and of feeble-

minded. But they feel the Rorschach test's validity is not yet established for normal persons.

Interest Tests

Interest tests are used chiefly in vocational guidance. Max Freyd made up a test listing 72 occupations to which a subject responded: Like, ?, or Dislike. Another part of the test listed over 100 items that a person might like or dislike; among them were fat men, nervous people, solitaire, picnics, football. Freyd found distinctly different interests in socially inclined persons and mechanically minded ones.

EDWARD K. STRONG, of Stanford University, developed a "Vocational Interest Blank" that is used a good deal. In the test for men, subjects record the comment, Like, Indifferent, or Dislike to about 400 items. Thirty occupations are scored separately to see how each subject's interests compare with interests of persons successful in each field. The women's test is scored for 18 occupations. Strong does not claim that his test will predict accurately a person's success in a given occupation. Vocational guidance psychologists report it the most useful test to direct students toward suitable occupations and—what is more important—to keep them out of fields for which they are unfit.

Louis L. Thurstone analyzed Strong's Interest Blank statistically and found four basic interests: science, language, people, and business. He showed also which interests are strongest in persons in various occupations. For example, engineers have much scientific interest; lawyers and advertising men lean toward language; teachers, preachers, and personnel workers are interested in people; while real estate men and accountants like business.

Although interests are determined largely by training, Thorndike and others find them remarkably consistent over long periods of time. Strong notes one exception: noticeable changes of interest occur between 15 and 25 years of age.

The biggest psychological differences between men and women, Lewis Terman and Catharine Cox Miles find, are their interests. Men incline toward adventure, physical activity, science, mechanics, and business. Women tend toward sedentary, domestic, esthetic, and humanitarian interests.

Each test described above measures but a small aspect of personality. In actual personality diagnosis, test results, along with facts about individual development and behavior, are assembled in a complete case study. The next chapter describes this.

CHAPTER XI

How Personality Develops

JAMES BALDWIN FREUD ADLER KRETSCHMER
COOLEY G. H. MEAD THOMAS ZNANIECKI M. MEAD
BENEDICT DOLLARD BURT SHAW PLANT
MURPHY NEWCOMB SYMONDS STAGNER

How much is personality influenced by one's body-build? By endocrine glands? What is the Freudian theory of personality development? What phases of home and family life are most important to a child? What other factors may play a significant part in building personality?

ONE'S PERSONALITY RESULTS from a combination of physiological and social forces. Heredity lays physical foundations. Environment, including one's home and family, friends, school, neighborhood, community, and nation, also affect us indelibly. Several attempts have been made to evaluate the relative importance of these factors. Whether the physical or social factors contribute most to personality is the subject of numerous investigations and also of considerable dispute.

Constitutional Types

On the biological side of the argument stands ERNST KRETSCHMER, a German psychiatrist. He distinguishes three

body types. The "pyknic" is short and stout or at least thick set. The "leptosome," or "asthenic," is tall and thin. The "athletic" is muscular and well proportioned. In mental hospitals Kretschmer examined manic-depressive and schizophrenic (dementia precox) patients. (Manic-depressive persons show extreme elation, extreme depression, or alternate between the two. Schizophrenics show emotional apathy, introversion, and withdrawal from reality.) Manic-depressives, Kretschmer found, tend to be pyknic in type while schizophrenics are leptosome and athletic. Kretschmer believed practically all persons of pyknic body build are "cyclothyme" in temperament, that is, they alternate in mood and are extroverted. Most leptosomes are "schizothyme"—inclined to be shy, serious, and introverted, he reported.

Kretschmer's interesting findings on the body form of psychotics are confirmed by other studies. Yet the body-form differences he notes between schizophrenics and manic-depressives actually may be due to their age differences, because schizophrenics average many years younger than manic-depressives; persons tend to become shorter and heavier as they grow older. Among normal individuals there is practically no evidence that a relation exists between body form and personality type.

Chemical Bases of Personality

In 1928 Gilbert J. Rich measured the relation between body alkalinity and emotional excitability. College students and clinic patients were rated for excitability by persons well acquainted with them. Their alkalinity, as revealed in saliva or urine, showed a slight positive correlation with the degree of excitability assigned them on the ratings. Most other attempts to relate biochemical conditions with personality have failed.

Louis Berman, an enthusiastic endocrinologist, dramatizes the role of endocrines in a book called *Glands Regulating Personality*. After describing abnormal behavior that results from endocrine disorders, he tries to show that the endocrines dominate

personality in normal persons. According to Berman, the "adrenal personality" is vigorous, energetic, persistent, and efficient; adrenal women have masculine traits and excel as administrators. Persons short in adrenal secretions commonly are neurasthenic. They lack energy, are irritable, indecisive, and subject to aches and pains. Berman describes two pituitary personalities: the prepituitary type, caused by overactivity of the pituitary anterior lobe, is predominantly masculine; the postpituitary, caused by overactivity of the posterior lobe, is excessively feminine. A man with an overworking postpituitary shows female traits of body and mind, including a tendency toward periodic moods analogous to the menstrual cycle.

Berman shows subthyroids as underdeveloped physically, listless, dull, and susceptible to disease. Hyperthyroids are restless, energetic, keen, and impulsive. The thymocentric personality, dominated by the thymus gland in the upper chest, is physically fragile, uninhibited, often abnormal sexually, and even criminal in tendency.

Berman supports his type theories by labeling great historical figures. Napoleon was a thymocentric, he says, with marked prepituitary tendencies in his early and mature years. His decline and downfall Berman attributes to the gradual appearance of postpituitary dominance.

Neither psychologists nor endocrinologists accept Berman's glandular explanations of personality. Experts in the psychology of personality like Ross Stagner and Kimball Young say that our present knowledge does not justify such an interpretation. It fails to account for social influences and effects of learning. No psychologist denies that abnormal glandular conditions seriously affect personality; endocrine knowledge often helps clinicians explain behavior disorders. But most personalities cannot be explained by glands. For them other interpretations must be found.

Indirect Physical Influences

Though personality traits do not depend directly upon body form, blood chemistry, or endocrine glands, important connections may exist between physique and personality, ALFRED ADLER points out.

Adler noticed that "feelings of inferiority" often develop in persons having a physical handicap. Lame, undersized, ugly, or deformed children may feel inferior and attempt to compensate for their defects, real or imagined. Their whole personalities may be affected by the compensation. Actually the inferiority does not arise from the defect itself, but from the unfortunate comparison with normal persons. If everyone were crippled, none would feel inferior. If all women were homely, none would be concerned about her lack of beauty. Thus physical factors influence personality only because social factors make them important.

Freudian Theory

SIGMUND FREUD, developing psychoanalysis to cure neurotic persons, worked out his theory of personality. Every person has a fundamental drive or source of energy called libido. Broadly speaking it is a sexual drive. The libido springs from the vast unconscious part of our mental life. Our complete self includes the Id, Ego, and Super-ego. The Id is our primitive animal nature. Located in the unconscious, it constantly strives to satisfy the libido. Our rational self is the Ego, which controls the Id's animal urges and "represses" them into the unconscious, though it does permit some expression of Id impulses. Similar to conscience, the Super-ego is a repository of moral ideas. It works on the Ego to repress the Id's socially reprehensible tendencies. The Super-ego and Id are in continual conflict, which the Ego tries to resolve. In a normal person the conflict is resolved successfully.

Freud traces personality development. A baby's libido is undirected. In the Narcissistic period, named for the legendary youth who fell in love with his own image, a young child's libido turns toward himself. When four or five, a child's libido attaches to an external object—one of his parents.

Emphasizing the libido's sexual nature even in childhood, Freud introduced his famous concept, the "Oedipus complex." The male child has sexual love for his mother. Jealous of his father, he comes actually to hate him. Conversely, a little girl develops intense father love, with hostility toward the mother. Normally, says Freud, the Oedipus complex disappears at adolescence when the libido fixes on adolescents of the opposite sex.

Freud's emphasis on infant sexuality is confirmed in careful studies made by Susan Isaacs, Gilbert V. Hamilton, and others. With regard to the Oedipus complex, however, experimental studies do not confirm Freud's view. Terman, for example, found no evidence that boys favor their mothers and girls their fathers, but rather that both boys and girls favor the mother slightly. Studies of the personality development of children agree roughly with Freud's theories of libido development, but with many exceptions.

Social Factors in Personality Development

WILLIAM JAMES, JAMES M. BALDWIN, and other early psychologists have noted how a child's early social contacts help to build his "self" or "social self"—later termed "personality." CHARLES H. COOLEY, a sociologist, has stressed the influence of parents and others with whom a child associates constantly. Selfhood, or personality, including ideas, attitudes, and even intelligence, depends a good deal on what kind of persons they are and how they treat the child, Cooley says.

GEORGE H. MEAD, a philosopher, believed that a child in his first social contacts assumes a role and plays a part. Early roles

probably imitate the father or mother, later the policeman, cook, storekeeper, or cowboy. From these roles, both realistic and imaginative, emerges a generalized behavior pattern basic to his personality, Mead says.

Sociologists and anthropologists stress the importance of environmental factors in personality development. WILLIAM I. THOMAS and FLORIAN ZNANIECKI studied Polish peasant immigrants in the United States. They found great changes occur, over a period of years, in personality, attitudes, and social organization because of the new environment. Thomas believes, as do his fellow sociologists Ernest W. Burgess and Ellsworth Faris, that the cultures in which people live and the cultural changes they experience affect their personalities in major ways.

2) MARGARET MEAD, well-known American anthropologist, found that adolescent girls in Samoa do not suffer the "storm and stress" common among girls of our culture. Samoan customs permit early sexual experience. Adolescents have a specific station in society, whereas in our culture a girl's rights and privileges depend mostly on her parents' notion of what is good and proper. Some girls "date" freely at fourteen, others are shadowed by chaperons until nearly twenty.

That Samoan adolescents pass through puberty free from conflict suggests that the so-called "typical" adolescent difficulties depend on social instead of biological factors.

Dr. Mead studied psychological differences between men and women in three neighboring but culturally contrasting groups. Local customs, she discovered, can modify "masculine" and "feminine" temperament a good deal. She says:

"The Arapesh ideal is the mild, responsive man married to the mild, responsive woman; the Mundugumor ideal is the violent aggressive man married to the violent aggressive woman. In the third tribe, the Tchambuli, we found a genuine reversal of the sex-attitudes of our own culture, with the woman the

dominant, impersonal, managing partner, the man the less responsible and the emotionally dependent person.

"These three situations suggest, then, a very definite conclusion. If those temperamental attitudes which we have traditionally regarded as feminine—such as passivity, responsiveness, and a willingness to cherish children—can so easily be set up as the masculine pattern in one tribe, and in another be outlawed for the majority of women as well as for the majority of men, we no longer have any basis for regarding such aspects of behavior as sex-linked. And this conclusion becomes even stronger when we consider the actual reversal in Tchambuli of the position of dominance in the two sexes."

RUTH BENEDICT, another noted American anthropologist, points out striking personality differences among peoples in various cultures that stress different values. The Zuni Indians of New Mexico, whose culture demands conformity to tribal ritual, lack initiative and individualism. In contrast, the Dobuan people of New Guinea are competitive, deceitful, and dominated by a belief in magical formulas and incantations. Kwakiutl customs emphasize striving for prestige, superiority, and self-glorification. Apparently tribal values influence the personalities of all individuals in the group, though some exceptions doubtless exist.

Even in isolated communities of our own country we can see how environment affects personality. Mandel Sherman discovered that children living in a remote mountain hollow of Virginia have little initiative or imagination. They do not even play. Practically no social organization exists. Nor does competition or frustration. The very young children resemble those in nearby villages. As they grow older they become listless, dull, and superstitious like their adult relatives.

JOHN DOLLARD, of Yale University, believes certain social and cultural criteria must be applied in tracing personality development. The customs of a person's social group must be known. His

family must be studied carefully because it affects his personality vitally. Special attention should be given to the relationship between biological factors like endocrines and all the social forces influencing him. Throughout his life his personality is shaped by and interwoven with his social environment.

Lawrence K. Frank says "culture is literally built into the organism." Custom determines even the intervals between meals, time of weaning, type of toilet training, and kinds of stimuli to which persons respond emotionally. All behavior patterns that parents transmit to their children are cultural products. Important among them are moral ideas, social attitudes, and interests. Frank concludes that culture is the ground from which personality emerges.

Home Atmosphere

Psychologists now pretty well agree that social factors are the most important in shaping our personality traits. First comes the family. In our culture, as in most cultures, parents and home conditions mold the child in his early formative years. A congenial home atmosphere, with good relations between the parents and between parents and child, is essential for a well adjusted personality to develop. On the other hand, disrupted homes often produce unstable, badly adjusted personalities.

Ample evidence supports this. CYRIL BURT, an English psychologist, found that 58% of the delinquents he observed came from broken homes where families were split by death, divorce, or other absence of one parent. Only 25% of comparable non-delinquent children are products of broken homes. More than a dozen studies show the same thing. Apparently the death or absence of one parent is a factor tending to distort a child's personality.

Hornell Hart and E. B. Hart, sociologists, point out how constant antagonism between parents can disrupt a child's personality. The child has a close emotional tie to each parent. Hence

their quarrels cause serious conflict in his own personality. Often the conflict leads to abnormal or anti-social behavior.

A Viennese psychologist, August Eichhorn, reported that children in his institution for delinquents came almost entirely from disrupted or disharmonious homes. La Berta W. Hattwick, Winnetka child psychologist, found that pre-school children from calm happy homes behaved cooperatively and showed good emotional adjustment. They were remarkably free from jealousy, nervous habits, sulking, and fears. In contrast, children from homes marked by tension and conflict between parents proved uncooperative, emotionally insecure, disturbed and given to jealousy, crying, fears, and nervous habits.

Adults whose personalities were not warped in childhood by emotionally upset homes tend to have happier marriages. This was pointed out by Lewis M. Terman and by the University of Chicago sociologists Ernest W. Burgess and Leonard S. Cottrell. Happy marriages are commonest among persons whose parents were happily married.

Parent-Child Relationships

Sigmund Freud pointed out that parents' behavior may bring about love, anxiety, or hate in a child. Excess parental tenderness, he said, "spoils" the child with too much love and often leads to neurotic diseases later.

More convincing than psychoanalytic observations are data from large-scale scientific studies showing the correlation between personality and family factors.

Cyril Burt found defective home discipline among 61% of his delinquent children and among less than 12% of his comparable non-delinquent group. August Eichhorn showed that parental neglect causes behavior problems in children as much as over-protection does. Delinquency results mainly from parents rejecting a child, not from excessive love, which merely encourages childishness and immaturity, he pointed out.

Richard H. Paynter and Phyllis Blanchard, clinical psychologists, analyzed the backgrounds of delinquent and behavior problem children brought to clinics. Home training and discipline were found at fault in 90% of cases. SHELDON and ELEANOR GLUECK, psychiatrists, found that 70% of delinquents' parents were either too rigid or too lax in their discipline. ROSS STAGNER, a specialist in personality, reports that excessive punishment typically results in revolt, possibly with delinquency, submission, and withdrawal marked by daydreaming and other escape devices, or outward submission with smoldering inward antagonism. All have bad effects on personality development.

Parental rejection and overprotection were called by Marion Kenworthy and David M. Levy, New York psychiatrists, the most important factors influencing child behavior and personality. Levy said overprotection may be "dominating." If so, a child becomes submissive and dependent. Or overprotection may be "indulgent," which often brings about aggressiveness, bullying, and even delinquency in a child. Rejection by parents is the greatest single cause of emotional insecurity in delinquent children, William Healy and Augusta Bronner, of the Judge Baker Foundation, discovered.

PERCIVAL M. SYMONDS, of Columbia University, studied the personalities of 31 children "accepted" and loved by their parents. He compared them with 31 rejected and neglected children. In general the accepted children proved emotionally stable, well socialized, calm, and interested in things. The rejected children showed emotional instability, restlessness, indifference, and antagonism.

Symonds also contrasted 28 children having dominant parents with an equal number having submissive parents. Analyzing their personality traits he found the dominated children polite, loyal, dependable, and docile, but also self-conscious, shy, and lacking in initiative. The children of submissive parents were aggressive, disobedient, stubborn, and antagonistic, but at the

same time independent and resourceful. Weighing good against bad results, Symonds concluded that some golden mean between parental dominance and submission is best.

Position in the Family

For Alfred Adler the chief human motive is a striving for superiority, which actually is a response to our feelings of inferiority. Younger children in a family, says Adler, feel inferior to their older brothers and sisters. They compensate by developing a great drive for superiority. A child's personality pattern depends a good deal on his family position—whether he is an oldest, middle, youngest, or only child.

Results of studies that compare the personalities of older, younger, and only children are inconclusive and contradictory. Summarizing 50 of them GARDNER MURPHY, LOIS MURPHY, and THEODORE NEWCOMB in their *Experimental Social Psychology* say that no evidence supports the claim that a certain ordinal position in the family affects personality. "Psychological" position in the family, on the other hand, is important, they point out. This depends on the child's emotional relationships with his parents and with brothers and sisters.

School and Personality

Compared to the home, the school plays a small part in shaping a child's personality. Yet most children spend ten or twelve years in school. What kind of schools they attend and what kind of teachers they have influence their intellectual, emotional, and social growth considerably.

Ira S. Wile, well-known New York psychiatrist, shows how hard a time the dull child has trying to meet school standards. Unless given personal attention or placed in a special group, he probably reacts to his inadequacy by open rebellion or passive daydreaming. Both have had consequences in personality development.

Teachers face a difficult job coping with pupils' personality problems. The child psychologists John J. B. Morgan and Caroline Zachry, in their books on children's personality maladjustments, frequently note aggressiveness, insecurity, daydreaming, glandular difficulties, over-dependence, or anxiety. Unfortunately most teachers are not trained to deal adequately with pupils' problems. E. K. Wickman found that teachers consider sex offenses, lying, cheating, impertinence, and truancy the major problems. They rated as rather inconsequential seclusiveness and withdrawal. Several clinical psychologists, on the other hand, believe the unsocial behavior more serious and symptomatic of maladjustment.

Teachers influence their pupils a good deal, directly or indirectly. Studying honesty MARK A. MAY and HUGH HARTS-HORNE found that pupils of certain admired teachers cheated very little, while those of disliked teachers cheated often. William C. Trow cites the case of a sensitive little girl whose adjustment from year to year hinged on the type of teacher she had. An impatient, dominating, or "yelling" teacher frightened and upset the child completely. Having only one sympathetic teacher out of eight, the girl determined never again to enter a schoolhouse after receiving her diploma.

Education affects student attitudes, especially at the college level. Daniel Katz and Floyd H. Allport, testing college students, discovered more liberal religious attitudes in upperclassmen than in lowerclassmen. A trend toward more liberal social and economic views as students go through college was found by Percival Symonds and others.

The important values of a culture naturally are stressed in its educational system. Mark A. May and Leonard Doob point out that the basic competitiveness of our culture is promoted in schools by examinations, grades, preferential treatment of children, and athletic contests. In their daily activities pupils compete more than they cooperate. At the same time teachers incon-

sistently emphasize the virtues of cooperation. Karen Horney, a psychoanalyst, believes this inconsistency causes conflicts in children's personalities that may result in real maladjustment.

Companions and the Community

In the school years a child is especially responsive to his companions and to many aspects of the community where he lives. Chicago sociologists studied these influences as they relate to juvenile delinquency. CLIFFORD SHAW found almost perfect correlation between the kind of neighborhood and its delinquency rate. Near Chicago's downtown "loop," slum areas lie among railroad yards, vacant lots, factories, and broken down warehouses. Here delinquency is high. As one goes toward outlying residential areas, delinquency drops. Cyril Burt found the same situation in London, and recent studies confirm it for Philadelphia, Boston, Cleveland, and other cities.

William Healy noted how a child's companions affect his morals and conduct. Almost two-thirds of child delinquencies in Chicago and Boston trace directly to bad companions, he learned.

Another sociologist, Frederick M. Thrasher, now at New York University, studied more than 1,300 Chicago gangs. Not all of them influenced their members badly. The gang, he discovered, gives a youngster important social contacts. He gains status by taking a role in his gang. On the other hand, gangs flourish in bad neighborhoods. Often they lead children to become truants, then hoodlums, delinquents, and even criminals.

Minority Group Status

Belonging to an unfavored minority racial or national group may have considerable influence on personality. In our country a Jew or Negro often reflects in his personality the prejudice and discrimination constantly directed against him. Recently John Dollard, E. Franklin Frazier, and other investigators, sponsored by the American Youth Commission, studied the personality de-

velopment of Negro youth. Some Negroes, they found, accept their inferior status without apparent bad personality effects. Others develop aggressive, chip-on-the-shoulder attitudes, trying to "get back at" white people. Still others become servile, humble, and submissive. Among the factors determining a Negro's reaction are his experience with white people, his family training, age, intelligence, economic status, and prevalent attitudes in his community.

Effects upon personality of minority group membership has been studied less than other social influences. Present indications, however, such as the American Youth Commission studies, point to greater future interest and research in this area.

Economic Factors

Just how much economic factors affect personality is hard to say, but their influence is very extensive. Poverty contributes to many, but by no means all cases of delinquency. The clinical psychologist C. M. Louttit says that the conditions which accompany poverty (poor neighborhood, overcrowding at home, parental worry, and inharmonious homes) do more to cause juvenile delinquency than poverty itself. His conclusion is based on data of Burt, Healy, and the Gluecks. ✓

JAMES S. PLANT, psychiatrist and director of New Jersey's Essex County Juvenile Clinic, finds that overcrowded living conditions accompanying poverty influence personality in unfortunate ways. Overcrowding, Plant says, means little or no personal privacy, no chance to develop a sense of individuality or to look objectively at oneself. It involves also the strain of constantly having to get along with others.

Certain advantages, on the other hand, may arise from low economic position. Arnold Gesell, director of the Yale Clinic of Child Development, and an associate found poor children better able to care for themselves than upper class children of the same age. But the poorer children fell behind in intelligence scores,

verbal ability, spontaneity, persistence, cooperativeness, and poise.

Ross Stagner found that college students of lower economic status were consistently more emotional than students of higher status. Seclusiveness and lack of self-confidence also accompanied low economic status. Stagner concludes that persons in lower economic groups are handicapped; poverty and hardship generally do not strengthen character.

The effects of unemployment on personality include demoralization, loss of confidence, loss of status, and a feeling of futility, especially with continued unemployment, according to both E. W. Bakke, Yale economist, and Paul F. Lazarsfeld, of Columbia University.

How economic status in the long run influences personality is described by ROBERT S. and HELEN M. LYND in *Middletown*, which surveys a typical small American city:

"It is after all this division into working class and business class that constitutes the outstanding cleavage in Middletown. The mere fact of being born upon one or the other side of the watershed roughly formed by these two groups is the most significant single cultural factor tending to influence what one does all day long throughout one's life; whom one marries; when one gets up in the morning; whether one belongs to the Holy Roller or Presbyterian church; or drives a Ford or a Buick; whether or not one's daughter makes the desirable high school Violet Club; or one's wife meets with the Sew We Do Club or with the Art Students' League; whether one belongs to the Odd Fellows or to the Masonic Shrine; whether one sits about evenings with one's necktie off; and so on indefinitely throughout the daily comings and goings of a Middletown man, woman, or child."

The Personality Pattern

It is clear that personality development results from many influences that operate in and upon a child. The temperament

of an individual—that is, his underlying energy and emotional tone—apparently are affected by his endocrine glands, nervous system, and other physical or physiological conditions. But these factors by no means determine what Gordon Allport calls “the finished portrait” of personality. An individual’s personality pattern, which includes traits, attitudes, interests, values, and ideals, is largely a product of his environment. The quality of a child’s home and family is of paramount importance, but his school experience, his friends, his community, his socio-economic status, and the whole culture pattern in which he lives also are significant. Evaluating the relative importance of these forces is a most difficult job for the psychologist; thus far only the surface has been scratched.

CHAPTER XII

Mental Disease

HIPPOCRATES WEYER PINEL
DIX KRAEPELIN BLEULER GRIESINGER
BEERS CAMPBELL WHITE JACKSON
MEYER ROSANOFF LENNOX

How long has mental disease been known? When did modern methods of treatment begin? How are mental diseases classified? What is the difference between organic and functional disorders? Do cures for mental diseases exist?

ABOUT ONE PERSON of every twenty in the United States will at some time during his life be treated in a mental hospital. The care and cure of such persons is a tremendous problem.

Apparently mental disease has always existed, but only in the last fifty years has it been handled scientifically. We have progressed a long way from the days of cells and chains for the insane. We still have far to go to reach an ideal solution.

The Protest of Hippocrates

Ancient records reveal cases of ravings, convulsions, and stupors. Evil spirits were believed to be the cause, and often persons "possessed" were put to death.

Occasionally a voice protested. HIPPOCRATES, a keen-witted

Greek doctor living in the Age of Pericles, struck out against traditional views. Writing of epilepsy, then called the "sacred disease," he said it had a natural cause and was no more sacred or divine than other diseases. He believed mental disease has a physiological basis, often a disorder of the yellow or black bile. "If you cut open the head," Hippocrates said, "you will find the brain humid, full of sweat and smelling badly. And in this way you may see that it is not a god which injures the body, but disease." He described many mental abnormalities, like phobias, loss of memory, and mental confusion. Classifying mental diseases he included epilepsy, mania (which he called "abnormal excitement"), extreme depression (termed melancholia), and paranoia (defined as mental deterioration). Hippocrates remained the chief medical authority for many centuries.

Background of the Modern Period

The Middle Ages brought demonology and witchcraft, though mentally diseased persons often were treated kindly by religious ministrations. Miraculous cures sometimes were reported, as when a paralyzed woman would recover after several visits to a saint's tomb. Late in the fifteenth century belief in witchcraft became widespread; for almost three hundred years it flourished. Hundreds of mentally ill persons, accused of witchcraft and of being possessed by the devil, were killed.

At the same time modern science was beginning. Juan Vives, a Spaniard, and the Germans Cornelius Agrippa and Paracelsus, among others, cried out against the stupid brutality practiced in the name of religion. In the sixteenth century a Dutch doctor, JOHANN WEYER, wrote a thorough refutation of witchcraft. He cited many cases of mental disease, explaining them in remarkably modern fashion. For example, he noted that suggestion helps bring about such disorders. Weyer was the first doctor to concern himself chiefly with mental diseases. Actually he foreshadowed psychiatry. But he was ahead of his times; his writings

were banned by the church and remained so until the twentieth century.

Pinel's Humane Attitude

During the French Revolution PHILIPPE PINEL, a doctor interested in mental diseases, broke daringly with tradition. He insisted on treating mental patients humanely. Appointed director of the Bicêtre, a grim and filthy Paris hospital where the insane were chained like animals, he first of all removed the chains. He treated the patients with kindness and consideration. He studied each individually and drew up individual case histories. He classified mental disorders. Though his simple classification soon was replaced by better ones, it marked the beginning of scientific psychiatry.

Insane persons have sick brains, Pinel argued. They should be treated with kindness, like anyone with a physical ailment. Against bitter opposition he put into practice his theory of humane treatment. And he was rewarded by seeing many patients recover.

Other Pioneers in Humane Treatment

While Pinel was reforming the Bicêtre, an English Quaker named WILLIAM TUKE became aware of the horrible condition of English lunatic asylums. He established "York Retreat," a pleasant country house where mental patients lived, worked, and rested in a kindly religious atmosphere.

Tuke's experiment attracted considerable attention. In America a similar venture called the "Hartford Retreat" was founded by DR. ELI TODD in 1824; it became a model for American mental institutions.

Treatment of the insane improved rather slowly until about 1840. Then DOROTHEA LYNDE DIX, a Massachusetts school teacher, became aroused by shocking conditions which she encountered in prisons and asylums. With determination and

energy, Miss Dix investigated further and presented her findings to the public. In time she influenced the legislatures of 20 states to establish or improve 30 mental institutions. Addressing a "memorial" to Congress she described the appalling conditions: she had seen "more than 9000 idiots, epileptics and insane in the United States, destitute of appropriate care and protection . . . bound with galling chains, bowed beneath fetters and heavy iron balls attached to drag-chains, lacerated with ropes, scourged with rods and terrified beneath storms of execration and cruel blows; now subject to jibes and scorn and torturing tricks; now abandoned to the most outrageous violations."

Indefatigable Miss Dix carried her crusade to Europe. She succeeded in establishing numerous mental institutions, notably in Scotland. Her influence became world-wide. It extended to prison reform and work with mental defectives, besides the mentally diseased. Seldom has one person put across so vast a social reform as Dorothea Dix.

Clifford Beers and Mental Hygiene

Early in the present century CLIFFORD W. BEERS, a patient in a mental hospital, noted in his lucid moments the shocking stupidity, inefficiency, and ill-advised treatment of patients which still characterized our institutions. Later he recovered and left the hospital. In a book called *A Mind That Found Itself* he describes his experiences. Beers was able to interest a number of famous people, such as William James and Theodore Roosevelt, in his plan to reform conditions in mental hospitals.

Out of his work grew the "mental hygiene movement," dedicated to improving the personnel and procedures in our hospitals for the insane. The National Committee for Mental Hygiene, now international in scope, has expanded its work to include the prevention of mental disease. Many child guidance clinics that deal with personality and behavior problems have been set up

throughout the country, largely as a result of the efforts of Beers and his mental hygiene associates.

Kraepelin's Classification

Nineteenth century psychiatrists believed pretty generally that mental diseases have a physiological basis. WILHELM GRIESINGER, for example, in 1845 wrote that insanity results from disorders of the brain and nervous system and is therefore a physician's problem.

EMIL KRAEPELIN, a late nineteenth-century German, one of the two or three greatest figures in psychiatry, made the first fairly complete classification of mental disease. Despite some criticism, it was adopted the world over. He based his classification on causes of the disease, how much of the brain and nervous system it involved, the variety and course of symptoms, and methods of treatment. His fifteen major headings included disorders of infection, of exhaustion, of intoxication, brain diseases, paranoia (delusions), epilepsy (periodic convulsions), neuroses (milder mental and emotional disorders), and mental defect (imbecility and idiocy). Kraepelin believed mental diseases caused mainly by external conditions are curable; those caused by constitutional factors, incurable. A curable disease is manic-depressive psychosis, wherein the patient suffers from extreme elation, depression, or an alternation of the two. On the other hand, said Kraepelin, the severe mental deterioration called dementia precox can not be cured because its source is brain disease, defective metabolic processes, or some other bodily condition.

Current Classification

In 1933 the American Psychiatric Association adopted a classification that includes 22 major groups of mental disorders and 36 minor ones. It begins with diseases having a definite organic

basis and proceeds to those having no known physical cause. John J. B. Morgan condenses the list thus:

1. *Feeble-mindedness*, or mental deficiency.
2. *Neurosyphilis*, caused by syphilitic infection of the brain and nervous system. General paresis is the commonest form.
3. *Traumatic psychoses*, caused by physical injuries to the central nervous system.
4. *Senile dementia*, or old age neural deterioration.
5. *Somatopsychoses*. Mental disorders sometimes accompanying infections or glandular diseases.
6. *Toxic psychoses*. Disorders resulting from drugs and poisons.
7. *Epilepsy*. A group of disorders involving convulsive seizures, generally with loss of consciousness.
8. *Schizophrenia*, or dementia precox. "A mental disease characterized by an extreme disorganization of the emotional life, hallucinations, fantastic delusions, personality disintegration, with relative intellectual preservation."
9. *Manic-depressive psychoses*. Disorders involving extreme exaltation, extreme depression, or alternation between the two.
10. *Paranoia*. Persistent delusions, usually of persecution or grandeur.
11. *Psychoneuroses*, or neuroses. Disorders having no known organic basis; milder than psychoses.
12. *Psychopathic personality*. A term applied to persons having no discernible mental disorder except that they can not adjust themselves morally, socially, and legally.

Organic versus Functional Disorders

Late in the nineteenth century psychiatrists began to distinguish between organic and functional mental disorders. Before that, mental disease generally was believed to have a physiological cause—some injury to the organism's structure. Then it became clear that certain diseases, notably neuroses, involve no known structural impairment. Here the trouble is functional.

Harry L. Hollingworth likens the distinction between organic and functional disorders to two types of automobile trouble. A car may balk because some part breaks down. A spark plug cracks, the gas line clogs, or the radiator freezes. Clearly these are "structural" causes. Replace the broken parts and the car runs again. On the other hand the car may stall though its "parts" are in good order, if some of them are *out of adjustment*. Perhaps the ignition points should be moved closer together, the fan belt tightened, or the gas mixture regulated. Here the trouble is not defective parts, but faults in organization or function. Hollingworth adds that the distinction between structure and function may be vague, but that it is useful to know whether one needs to buy new parts or just make a few adjustments.

The functional view of mental disease for the most part grew out of the work of Freud and of several French psychiatrists, whose contributions we shall examine shortly. After Kraepelin and his contemporary, EUGEN BLEULER, Swiss psychiatrist, schizophrenia, manic-depressive psychosis, and paranoia were considered functional disorders because no definite organic bases could be found for them. When structural changes were absent, it was naturally assumed that the cause must be functional.

Organic Disorders

General paresis, also called general paralysis and dementia paralytica, is marked by general mental and moral deterioration. Its cause is syphilitic infection of the brain and nervous system.

Its symptoms have been graphically described by the psychiatrists C. MACFIE CAMPBELL and WILLIAM ALANSON WHITE. Paretics show motor incoordination, particularly in their speech and handwriting. Attention wanders and memory fails. Intelligence and judgment are impaired. Most striking of all are the changes in personality. Fits of anger and impulsive acts become common. Personal appearance is neglected. Patients frequently turn to immoral talk and actions, and fail to respond to their relatives and friends. They become loud and boastful, and sometimes suffer from extreme delusions such as believing they have millions or billions of dollars.

Senile dementia is well described by Hollingworth and others. In old age mental changes may follow increasing physical deterioration. Critical capacity declines, as does general orientation and memory for recent events. Old people tend to worry about their health; they may easily become quarrelsome, suspicious, and self-centered. In more extreme cases of senile deterioration, patients develop delusions, hallucinations, and severe emotional upsets, though such persons usually do not live very long.

Epilepsy is generally classified with the organic mental diseases, though much doubt exists as to its actual bodily basis. Its chief symptoms, according to Hollingworth, are loss of consciousness, disturbed motor coordination, and convulsive spasms of greater or lesser extent. The severe form, known as "grand mal," occurs in about two-thirds of the cases; it is marked by violent convulsions and complete loss of consciousness. In the less drastic "petit mal" the patient loses consciousness for just a few seconds and seldom falls or suffers an actual convulsion. Frequency of attacks is extremely variable; they may occur all the way from several in one day to a number of years apart.

The cause of epilepsy is still a mystery. The English psychiatrist, HUGHLINGS JACKSON, suggested that it results from a sudden explosion of nervous discharges in the motor area of the cerebral cortex. Other interpreters disagree on details, but ac-

knowledge that some kind of imperfect physiological and neural functioning must underlie the attacks. Evidence as to the inheritance of epilepsy is claimed by some researchers and denied by others. Recently W. G. LENNOX presented evidence to show that a relationship exists between epilepsy and the severe headache known as migraine. The problem is complicated by the possibility that several forms of epilepsy exist, each of which may be caused by several factors.

Functional Disorders

Schizophrenia, or *dementia precox*, is the commonest of the serious mental diseases. According to Edmund S. Conklin, of Indiana University, about one-quarter of admissions to mental hospitals are schizophrenic.

Kraepelin used the term "dementia precox" to signify serious mental deterioration occurring early in life. He found its peak of incidence between ages 20 and 30, and attributed it to physiological causes. Bleuler noted that the disease often occurs earlier or later, and that some patients may be cured or may recover spontaneously. Bleuler doubted that it is constitutionally caused, and defined its chief symptom as emotional rather than intellectual disruption. He substituted "schizophrenia" as a more suitable name; literally this means a splitting of the personality, though technically it signifies a breaking away from reality.

The following illustrative case of schizophrenia, is mentioned in Karl A. Menninger's *The Human Mind*:

"A girl reared in the lap of luxury had been transferred from a finishing school to a co-educational college. She was very active socially, but owing to a technicality was not initiated into her sorority. Simultaneously she failed in one study, a unique experience for her. Finally there was 'a poor young professor' with whom, out of sport at first, and then seriously, she began a flirtation. His financial incompetence and other such matters mili-

tated against a full development of the affair and she and her friend broke off over a misunderstanding, but with much distress and pain.

"Suddenly, soon after, she leaped to her feet in the middle of the living-room and screamed at the top of her voice, assigning irrelevant explanations. She soon began to hear 'voices' which told her that there had been a wedding at the college, that she and the professor had been married, that everyone was looking for Mrs. S., herself. . . .

"Many other queeresses and delusions followed. She was pregnant; she had had a child. She was a queen or even an empress; . . . she was hypnotized, infected with syphilis, poisoned; gas was being shot into the keyhole, arrows were fired at her . . .

"This is a sample of her writing:

"The test therefore is this: that if in the past we have met with the glorious success of example and time we steadily acquire so law among men. To proceed, I am illegitimate, being an orphan in society I was taken at five years of age by England to be the subject of a hypnotic test most guards of Chicago are being brutally poisoned she's place so are my darling brothers the blue-eyed Congressmen.' "

The main symptom of schizophrenia is emotional abnormality, generally in the direction of apathy. Persons or situations which formerly aroused love or fear or sorrow are now met with indifference. Patients often become unaccountably happy or sad. Their mental ability, as shown by intelligence tests, does not deteriorate in most cases. But intellectual powers are divorced from other aspects of personality. For example, a patient may discuss current affairs very sensibly for a few minutes, then relapse into his world of daydreams or describe how people are trying to rob or poison him.

Since Kraepelin's day, psychiatrists have spoken of four types

of schizophrenia: *hebephrenic*, *catatonic*, *paranoid*, and *simple*. The *hebephrenic* form is marked by silliness and childishness of thought and action. The distinguishing sign of *catatonia* is either stupor and muscular rigidity or the opposite extreme of frenzied excitement and activity. *Paranoid* schizophrenics suffer from pronounced delusions and hallucinations. *Simple* schizophrenia is harder to describe than the other types as it has no clear-cut set of characteristics. Usually there is a pattern consisting of emotional blunting, withdrawal from reality, carelessness of personal appearance, lack of responsibility, and prevalence of fixed ideas (often relating to sex). As in the case cited above, foolish talk and signs of delusion and hallucination often appear. Many cases, however, do not fit into any of these categories and are sometimes referred to as "mixed types."

The second commonest of the functional psychoses is *manic-depressive psychosis*. It accounts for about 15% of admissions to mental hospitals. The term "manic-depressive" was introduced by Kraepelin, who noted that alternating periods of elation or depression may occur in the same individual, though many patients show only one form.

Mania may be mild or acute. It is marked by activity and excitement. Manics are full of energy, restless, noisy, talkative, and have one bizarre idea after another. In hyper-acute cases the patient becomes wild, delirious, and completely unmanageable.

The *depressed state*, by contrast, is characterized by inactivity and dejection, often with feelings of guilt and worry about health. In the extreme state, called depressive stupor, a patient is completely unresponsive—to an extent that he has to be fed by tube or injection.

A disorder commonly thought to be related to manic-depressive psychosis is *involucional melancholia*. This disease is most prevalent in women at the time of the menopause—between 40 and 55 years of age. Depression, agitation, irritability, anxiety, and guilty feelings typically occur, sometimes with delusions. In

extreme cases there is danger of suicide. Fortunately, however, most involuntional cases recover gradually over a period of two or three years, as the organism becomes adjusted to its new physiological status.

Another serious functional disorder is *paranoia*, a condition of fixed and systematized delusions without other personality disturbances. True paranoia is relatively rare, accounting for only about 2% of cases in mental hospitals. Formerly all patients having delusions were classed as paranoid; now delusions are known to be common in schizophrenia and other disorders.

The noted psychiatrist AARON J. ROSANOFF describes paranoids as having fixed suspicions, with delusions of grandeur and of persecution; otherwise they seem normal and rational. The paranoid is a complete victim of his delusions and is therefore dangerous. He may attempt to attack or even murder the person he believes is wronging him. Commoner than such extreme cases in the hospitals are the cranks or eccentrics who make wild complaints and accusations, or who plague friends and associates with their constant espousal of a single idea.

Causes, Treatment, and Prevention of Mental Disease

Humane treatment of mentally diseased persons relieves their suffering immeasurably. In some cases it even restores sanity. Modern mental hospitals, with their quiet, homelike atmosphere, sunbaths, tennis courts, occupational therapy, friendly physicians, nurses, and attendants, owe their existence to reformers like Pinel, Dorothea Dix, and Clifford Beers.

A few mental maladies are incurable. Nothing can be done to repair the damaged structures underlying senile psychoses, or to arrest the deteriorating process. With other diseases, too, chances of successful treatment are slim if the disease is of long standing and if the patient is middle-aged or elderly.

Often medical and psychological treatment aids a patient, though it may not cure him completely. Alcoholic psychosis, for

example, is alleviated when the patient ceases drinking, learns to rest and relax, and gradually builds up physically. After drug or dietary treatments an epileptic may be sufficiently improved to leave the hospital, though he must still live under a planned regime.

In the last forty or fifty years, however, notable progress has been made in our knowledge of certain mental disorders. RICHARD VON KRAFT-EBBING, Viennese psychiatrist, showed that general paresis resulted from syphilis. He inoculated paretic patients with syphilitic germs and found that they failed to show outward signs of that disease, which suggested strongly that they already had it in a less obvious form. Later HIDEYO NOGUCHI, Japanese bacteriologist who was associated with the Rockefeller Institute in New York, proved the case by discovering syphilitic spirochetes in the brain and nervous system of paretic cases. A few years later, JULIUS WAGNER-JAUREGG, another Viennese psychiatrist, found that high fever kills syphilitic germs and cures paretic patients. Until quite recently paretics were infected with malaria to produce the beneficial fever. Lately an improved technique induces the required high temperature with short-wave apparatus. Another successful technique is to inject an arsenic compound, tryparsamide, into the blood stream. By these methods about one third of paretic patients are cured and another third improves perceptibly.

Bleuler believed that schizophrenia can be cured. For years no specific cure was found; drugs, oxygen, and prolonged sleep treatments brought little success. In 1933 a Viennese doctor, MANFRED SAKEL, by accident discovered the remarkable effect of insulin shock on schizophrenic patients. Insulin can induce coma by decreasing sugar in the blood. In some way not yet fully understood a series of insulin shock treatments restores many schizophrenic patients to normality. A similar convulsion, induced by a camphor compound, metrazol, developed by DR. L. V. MEDUNA of Budapest, also often cures schizophrenia. As

would be expected, greatest success occurs with persons who have been ill only a short time or who have less serious forms of the disease. These new kinds of treatment are now being administered in all big mental hospitals. With their use something like 50% of schizophrenic cases recover or improve.

Though insulin and metrazol shock treatment fail to cure manic-depressive psychoses, a new kind of electric shock applied to the heads of manic or depressive patients produces a notable number of recoveries, though exact figures cannot yet be given. Some psychiatrists claim that electric shock is also effective in improving cases of involuntional melancholia. Others place more faith in glandular extracts which are designed to restore the endocrine equilibrium upset by the menopause. In any case the outlook is hopeful.

Prevention of mental disorders is a complicated medical, social, and psychological problem. We know how some mental diseases can be prevented; if persons are kept away from drugs, alcohol, and syphilitic spirochetes they cannot develop toxic psychoses or general paresis! Other diseases are a puzzle. Their prevention hinges to a large extent on whether they are inherited or acquired.

Unfortunately research on the causes of schizophrenia and other functional disorders has resulted in a variety of conflicting interpretations. Kretschmer, as we have seen, finds that body-build is the important factor in the development of schizophrenia and manic-depressive psychosis. Franz Kallmann, of the College of Physicians and Surgeons at Columbia University, insists on a hereditary interpretation of those diseases.

Most psychiatrists, however, agree with ADOLF MEYER of Johns Hopkins that functional mental disorders result from years of faulty habit formation. According to Meyer, psychoses represent the culmination of failures to make successful adjustments to one's environment. The causes of such failures may, of course, be hereditary or physiological, but are not necessarily so.

In the opinion of most psychiatrists, "predisposing" and "precipitating" factors cooperate to produce the functional disorders. Heredity predisposes certain persons toward mental disease, but disease does not actually appear unless precipitated by unfortunate experiences. Since regulation of heredity by eugenic measures is extremely difficult, the most practical plan is to note our potentially unstable persons and keep them away from the stress and strain of frustrating situations.

Looking back over the last 30 or 40 years, we find that encouraging progress has been made in understanding, treating, and preventing mental disease. One of the few fortunate by-products of World War II seems to be an increasing knowledge of how to rehabilitate cases of shell shock and other mental and nervous war casualties. The fight against mental disease is by no means won, but the number of recent successes makes future prospects seem bright.

CHAPTER XIII

Conflicts and the Unconscious

MESMER BRAID LIÉBEAULT BERNHEIM
CHARCOT JANET FREUD BREUER
ADLER JUNG PAVLOV MAIER LEWIN
RANK FERENCZI STEKEL HORNEY

What is mesmerism? How can hypnosis cure mental ills? How do conflicts arise? What does "neurosis" mean? Can neuroses be cured? What is repression? Where is the unconscious? Why is Freud important? How does psychoanalysis work?

MILDER than the serious mental diseases, or psychoses, are neuroses. Neurotic persons seldom are called "insane"; they are just "queer" or "eccentric." In most respects they seem normal. They hold jobs and go about their affairs like the rest of us. But they are shadowed by fears, anxieties, or obsessions; they are nervous and often have physical upsets like headaches, giddiness, indigestion, or other aches and pains. Neuroses arise from severe emotional conflicts not properly dealt with. Even now this fact is not generally realized.

Mesmerism

About 1760 a young Austrian medical student, ANTON MESMER, became interested in the peculiar theories of Paracelsus,

This Paracelsus, a sixteenth-century doctor, believed that magnetic influences from the stars can cure human ills. Mesmer hit upon the use of a magnet to "draw out" disease. He reported successfully curing cases of paralysis and convulsions. Soon he found that magnetic influences could be imparted by the human hand as well as by metal. This "animal magnetism" was labeled charlatanism by most doctors, though they had to admit it could effect cures. A royal commission was appointed that included the American minister to France, Benjamin Franklin, as well as Lavoisier, the chemist, and other great figures. This group studied Mesmer's work and concluded that the cures came not from magnetism but from the patient's imagination. Mesmerism was discredited further in scientific circles and even branded dangerous to public morals, but popular interest in it continued for nearly a century.

About fifty years later an English surgeon named JAMES BRAID studied the trance-like state that mesmerists produced. He noted that the patient's expectation was the most important factor, that the trance resulted mostly from suggestion. Braid introduced the term "hypnotism."

Doctors began to show interest in hypnotism and suggestion. A French physician, AMBROSE AUGUSTE LIÉBEAULT, used hypnotism in his practice at Nancy. It proved successful in cases of hysteria, a nervous disorder whose chief symptom is a physical ailment. Hysterical patients were cured of paralysis, blindness, tics, or anesthetics by positive suggestion. During the trance Liébeault told patients that their ailments would disappear; they did! He and his colleague, HIPPOLYTE BERNHEIM, after years of experience with hypnotism concluded that all persons are suggestible, though in different degrees.

Theories of Charcot and Janet

While Liébeault and Bernheim were practicing in Nancy, JEAN MARTIN CHARCOT began in Paris his studies of mental and

nervous disorders. The greatest neurologist of his day, Charcot held that hysteria has a physiological basis. Opposing the Nancy view he said that hypnosis is a symptom of hysteria—the hypnotic trance can be induced only in persons with hysterical tendencies. Charcot described three stages of the hypnotic state: lethargy or drowsiness, catalepsy or rigidity, and somnambulism or dissociation of personality. Liébeault and Bernheim disputed the inevitability of three such stages. They said that hypnosis varies according to the patient. Mild hypnosis, which is merely a passive, receptive state, can be induced in more than 80% of normal subjects, they pointed out. Bernheim presented data on 10,000 cases to prove the statement. Subsequent studies seem to verify the views of the Nancy School, though it is clear that hysterical persons can be most easily and most deeply hypnotized.

Charcot studied carefully the characteristics of hysteria, noting that neurological changes occur during hypnosis. He described the hysterical personality, finding it as common in men as in women, contrary to previous beliefs. He insisted that faith cures, such as those at Lourdes, occur in persons with hysterical tendencies as a result of the hypnotic influence of the shrine. Thanks to his prestige he succeeded in convincing men of science that hypnosis is a psychological fact.

Charcot attracted many able doctors to his Paris hospital and school. The greatest of these were PIERRE JANET and SIGMUND FREUD.

Janet found that hypnotized hysterical patients can recall events unremembered in the normal state. A forgotten emotional shock, for instance, would be revealed and thus give a clue to causes of the neurosis. By suggesting during the trance that the upsetting event was past and gone, Janet was able to make many symptoms disappear. He developed a theory that hysteria is a "dissociation," or imperfect integration, of personality. Normal personalities are well integrated. Hysterical personalities are split and subject to internal division.

Neuroses, Janet believed, arise from constitutional weakness and lack of energy, possibly with a hereditary basis. But he recommended psychological treatment, not drugs or other physiological therapy. He coined the term "psychasthenia" (meaning "weakness of the mind") to identify cases involving extreme fears, obsessions, and compulsions.

Freud and Psychoanalysis

What Charcot and Janet hinted obliquely, Sigmund Freud stated positively: that neuroses have a psychological origin. His remarkable theories and his technique of therapy for neuroses stirred the world as no other psychologist before or since has stirred it.

Sigmund Freud was born in 1856 in a little Moravian town, then a part of Austria-Hungary. He studied medicine in Vienna and lived there until 1938 when the Nazi annexation of Austria forced him into exile. He died in London in 1939.

Interested in neurology, Freud went to Paris in 1885 to study under Charcot. There he learned the use of hypnosis to treat hysteria. Once he heard Charcot say, in discussing a young woman's neurosis, that sex is always at the bottom of the trouble. This remark impressed Freud greatly and had much to do with the subsequent development of psychoanalysis.

Returning to Vienna after a year in Paris, Freud began treating neurotic patients with hypnosis. Having only partial success, he visited Liébeault and Bernheim at Nancy to study their hypnotic methods. Even after this he found hypnosis of doubtful value because some patients could not be hypnotized, and others who could, failed to recover.

Then he worked with a former colleague, JOSEF BREUER, who had developed a "talking out" treatment. Breuer discovered that a patient was helped if encouraged, under hypnosis, to "talk out" his emotional troubles. Breuer and Freud called this technique "catharsis" because it seemed to purge the patient of pent-up or

repressed emotions. Shortly after they published a book in 1895 called *Studies in Hysteria*, Breuer withdrew from the partnership and Freud carried on alone.

Freud soon gave up hypnosis and concentrated on the talking out method of free association. He told patients to relax, think about their troubles, and say everything that came to mind. He found this technique superior to hypnosis because the patient remained in an active, cooperative state, while coping with his difficulty.

The Unconscious

Freud's theory of personality, already sketched in an earlier chapter, proposes that the libido, or life urge, sexual in nature, originates in the unconscious. This concept of the unconscious is central to both the theory and practice of psychoanalysis.

Existence of an unconscious, as opposed to conscious, mental life was not a new idea. Johann Friedrich Herbart, seventy-five years before Freud, had made the unconscious an important part of his system of psychology. Harald Höffding and William James, older contemporaries of Freud, both wrote of the influence of the "subconscious mind" on human behavior. But Freud developed the idea more systematically and more persistently.

Mental life, said Freud, is divided into three parts: the conscious, preconscious, and unconscious. The conscious is much smaller and less significant than generally supposed. It is made up only of ideas and feelings present in immediate awareness. But other mental content is easily recalled to consciousness; this is the preconscious—material only temporarily absent from central consciousness.

Quite different is the unconscious. It is the greatest segment of mind, a huge reservoir which contains all our primitive impulses and strivings. Though completely out of consciousness, it can and does influence mental life tremendously. Forbidden or socially disapproved impulses from the unconscious constantly

strive to cross the threshold into consciousness and are restrained by the Ego, thus producing conflicts which, if serious enough, result in neurosis.

Repression and Dreams

Freud discovered that during free association patients fail to remember, or hesitate to express, certain painful or embarrassing items. Explaining this resistance Freud formulated his famous theory of repression: the Ego relegates unpleasant desires, memories, and ideas to the unconscious and resists the analyst's efforts to bring them to the surface. (However, in the course of time patients develop a strong attachment or "transference" to the analyst, which aids in breaking down this resistance.) The repressed items, generally sexual in nature, constantly seek outward expression. They may be identified, Freud found, by interpreting the patient's dreams.

During sleep, according to Freud, the Ego is relaxed; hence repressed desires and ideas may slip into consciousness as dreams. However, they are disguised. The true meaning is portrayed symbolically. Freud set about interpreting dream symbolism. Take an example, somewhat clearer than most of his interpretations:

"A man and a woman who were in love had spent a night together; he described her nature as maternal, she was one of those women whose desire to have a child comes out irresistibly during caresses. The conditions of their meeting, however, made it necessary to take precautions to prevent the semen from entering the womb. On waking the next morning, the woman related the following dream:

"An officer with a red cap was pursuing her in the street. She fled from him and ran up the staircase, with him after her. Breathless, she reached her rooms and slammed and locked the door behind her. The man re-

mained outside and, peeping through the keyhole in the door, she saw him sitting on a bench outside, weeping.

"In the pursuit by the officer with the red cap and the breathless climbing of the stairs you will recognize the representation of the sexual act. That the dreamer shuts her pursuer out may serve as an example of the device of inversion so frequently employed in dreams, for in reality it was the man who withdrew before the completion of the sexual act. In the same way she has projected her own feeling of grief on to her partner, for it is he who weeps in the dream, his tears at the same time alluding to the seminal fluid."

Freud does not give all dreams a sexual meaning. Essentially, he says, they fulfill wishes. Some gratify thirst, hunger, or a desire for liberty. But disguised and distorted dreams are mainly sexual. He lists the most common sexual symbols.

A house represents the human body. Male genital organs are symbolized by sticks, poles, trees, pencils, tools, weapons, balloons, and airplanes. Female genitalia are indicated by pots, caves, bottles, boxes, doors, rooms, and gates. Apples, peaches, or other fruit mean the female breast. Pubic hair of both sexes is symbolized in dreams by woods and thickets. Sexual intercourse is represented by dancing, climbing, and experiencing violence like being run over. Emerging from water signifies the act of birth.

Freud defends his interpretations by pointing out similar symbolism in fairy tales, folklore, songs, jokes, and epithets. For instance, the New Testament refers to woman as "the weaker vessel." Symbols are invariable, Freud says, though he admits the importance of knowing a patient's personality and life conditions in order to extract the real meaning from his dreams. Many psychoanalysts disagree with Freud, insisting that the meaning of all symbols depends upon the dreamer's experience. But all agree

that interpreting dreams helps the analyst understand a patient's conflicts and the content of his unconscious.

Freudian Dynamisms

Everyone adopts a device or "dynamism," according to Freudian theory, in order to resolve the inconsistency between his primitive, animal-like Id and the demands of reality. Repression is a common dynamism; it leashes unacceptable ideas and prevents their entering consciousness. Another device is "sublimation," by which the libido is channeled toward socially acceptable ends. Vocational interests, hobbies, civic activities, and even religion are considered examples of sublimation. "Rationalization" protects the Ego, or self, against awareness of unsocial motives by substituting socially approved reasons for behavior. "Projection" means assigning to other persons desires and urges that one's own Ego repudiates. "Regression" is a return to childish behavior and infantile types of gratification. "Conversion" signifies converting a conflict into physical symptoms; it is the mechanism underlying hysteria. Unconsciously adopted, these dynamisms are the Ego's attempt to resolve conflicts. They show up most clearly in neurotic persons, where the conflicts are greatest.

Neurosis and Its Treatment

Freud points out that all persons have childhood sexual complexes, with minor conflicts and repressions. But these are handled reasonably well by normal individuals. Neuroses result when the libido fixates on childhood love objects, such as one-self or one's parents, or when the delicate relationship between Ego, Super-ego, and Id gets out of balance, resulting in serious conflict. The frustration is facilitated when the demands of reality become excessively severe.

Psychoanalytic treatment aims to free the libido from its unfortunate fixations and to build up the Ego until the patient can

cope with his problems. By free association and dream interpretation the analyst comes to understand his patient's conflicts. When the patient is brought to the point in his treatment where he can accept the analyst's interpretation of his difficulties, he is on the way to recovery.

Alfred Adler and the Inferiority Complex

An early disciple of Freud broke away and set up a rival school called "individual psychology." ALFRED ADLER disagrees with Freud's emphasis on sex and his distinction between the conscious and unconscious. For Adler the basic urge is a striving for superiority. When this is thwarted, as frequently happens, the person feels inferior and an "inferiority complex" results. He then attempts to compensate for this inferiority by asserting himself in other ways. If this compensation activity gains recognition, the inferiority feeling may be removed. If the compensation is ill-advised and anti-social, it constitutes neurosis. Not sex repressions, but thwarted self-assertion, says Adler, causes neurotic disorders.

To treat neurosis according to "individual psychology," one must discover the "style of life" or role which the patient adopted early in childhood, chiefly as a result of his position in the family. All this is duly explained to the patient, so that he understands his inferiority complex and the failure of his compensatory efforts. He then is guided toward goals more socially acceptable and more within his capacity for achievement.

The Analytical Psychology of Carl Jung

Another early psychoanalyst who parted company with Freud is CARL G. JUNG. In Zurich he set up a school of "analytical psychology." Jung believes that the libido is energy which may take many forms. In the child it appears as hunger; later it becomes self-assertion or sex desire. For Jung the unconscious is not, as Freud believed, entirely unmoral and animal. It also

includes moral and even religious principles. The unconscious is partly personal, partly collective. The collective part consists of inherited primitive or racial ways of thinking and feeling.

Jung declares that Freud's interpretation of neuroses overlooked factors precipitating the disease. Neuroses occur, Jung says, partly because complexes built up in childhood persist and partly because some present difficulty overtakes a person's capacity to adapt. To treat neuroses Jung uses free association and dream analysis. But he begins by studying the present problem and how the patient meets it. Jungian analysis deals with both past and present, and tries to integrate conscious and unconscious trends of personality.

Other Psychoanalysts

Several other psychoanalysts have made contributions to the understanding and treatment of neuroses. One of Freud's earliest disciples, OTTO RANK, made well-known studies of myths and incest trends all over the world. He is best known for his "birth trauma" theory: the shock of leaving the womb and entering an unfriendly world is the basic cause of our emotional troubles. Neurosis is interpreted by Rank as a misguided attempt to return to the uterus, or to obtain rebirth.

Two other early Freudians, SANDOR FERENCZI and WILHELM STEKEL, objected to the length of time consumed by the orthodox "passive" technique of therapy. They favored the analyst taking a more active part in directing a patient's free associations. By one or another form of this method both Ferenczi and Stekel claimed that good results could be obtained in a few months, instead of the year or more usually involved in a Freudian analysis.

A recent reinterpretation of Freud which stresses cultural influences is presented by KAREN HORNEY, a psychoanalyst now practicing in New York. Conflicts and neuroses, she says, do not arise from instinctual or biological sources, as Freud generally

implied. They are produced by the contradictions in our culture. For example, we are taught brotherly love and unselfishness, but competition for success is also stressed. Out of such conflicts come hostilities, fears, and other neurotic symptoms. According to Dr. Horney's interpretation, neurotic persons in a given society are essentially alike, despite differences in heredity, because their conflicts are products of their common culture.

Neuroses Classified

From the work of Freud and nineteenth century psychiatrists emerged the following classification of neuroses:

1. *Hysteria*. A disorder wherein the patient's conflict leads to physical symptoms like paralysis and loss of sensitivity (anesthesia).
2. *Psychasthenia*. A loose category, comprising phobias such as fear of high places or closed places, obsessions, and compulsions like kleptomania (compulsive stealing) or pyromania (compulsive fire setting).
3. *Neurasthenia*. Abnormal weakness and fatigue, with numerous aches and pains.
4. *Anxiety neurosis*. Chronic worry; sometimes included under neurasthenia.
5. *Hypochondria*. Preoccupation with one's health and body functions. Often included with neurasthenia or anxiety neurosis.

To illustrate neurosis, an interesting case of hysteria described by LAURANCE F. SHAFFER, of the Carnegie Institute of Technology, is presented. A small-town boy with a fairly good voice came to the city to study singing—a move involving financial sacrifices by his mother. Soon he developed a peculiar soreness and stiffness of his throat muscles, which prevented his practic-

ing or singing in public. Study of the case revealed a serious unconscious conflict between the boy's desire to be a great singer and his fear that he was mediocre, possibly wasting his mother's money. The sore throat solved the problem. It got him out of his difficulty in a socially acceptable way. As Shaffer says, this ailment excused him from admitting failure; it satisfied him and his mother and society in general. With a throat ailment, he naturally could not sing, and no one would accuse him of being a failure or a quitter. Guided by the psychologist, the boy eventually saw his musical limitations. He decided that business was a better field for him. Later, when he sang for recreation his throat ailment had disappeared.

Shaffer summarizes several mechanisms of adjustment by which both normal and neurotic persons seek to resolve their conflicts. The above case shows adjustment by ailments. Adjustment by defense includes aggressive attempts to compensate for inferiorities. Adjustment by withdrawing involves a different technique—running away from the problem or taking refuge in daydreaming and infantile behavior. Another attempted adjustment is repression, an unconscious but purposive forgetting of the unpleasant. "Persistent nonadjustive reactions" include anxiety and worry, nervousness, fatigue, and various aches and pains. The above devices, says Shaffer, are adopted unconsciously, by trial and error, because they offer a means of resolving conflict and thereby attaining adjustment.

Experimental Neurosis

While studying conditioning in dogs, IVAN PAVLOV hit upon an interesting discovery which he called "experimental neurosis." A dog was trained to salivate by being given food whenever a circle of light appeared. The same dog was shown an elliptical patch of light, but was not fed and did not salivate. After the dog clearly differentiated between the circle and the ellipse, the latter was made more and more circular. When the two became

almost identical, the animal's powers of discrimination broke down. It salivated without restraint, barked, whined, and struggled to get out of its harness. The experimental conditions had placed so much strain upon the dog's ability to differentiate stimuli that it became a neurotic animal, according to Pavlov's interpretation.

Later investigators have followed Pavlov's lead. Howard S. Liddell, of Cornell University, produced nervous, disorganized behavior in sheep and pigs, using Pavlov's technique with some modifications. NORMAN R. F. MAIER, of the University of Michigan, trained rats to discriminate between two cards of different brightness; then changed the conditions and forced the animals to act without having any appropriate response. The rats showed abnormal behavior. They jumped wildly, ran violently to and fro, went into epileptic-like convulsions, and became rigid or passive as if in a coma. The essential condition for such abnormal behavior, says Maier, seems to be the necessity of reacting in a situation in which all ordinary modes of behavior have been removed.

Investigators are naturally cautious about introducing human beings into situations which might produce neurosis, interesting as the demonstration might prove from a research standpoint. Very recently, however, a few experiments have been done on the effects of frustration. One of the best known of these was performed by KURT LEWIN and two associates. Several nursery school children were given toys to play with, while observers rated their performance on a scale of "constructiveness." The youngsters were then allowed to play for fifteen minutes with a number of much more interesting toys. Then, without explanation, the children were forced to return to their earlier, less desirable playthings, though they could still see the fine toys at the end of the room. They revealed their frustration in various ways, the most significant being a great decrease in the construc-

tiveness of their play. In Freudian terms their frustration caused regression to a more infantile level of behavior.

In increasing degree students of mental abnormality are using experimental techniques. The laboratory can never duplicate successfully the complex conditions of actual living, but experiments such as those of Pavlov, Maier, and Lewin may well yield clues which will aid in understanding and controlling abnormal behavior.

CHAPTER XIV

Learning

LOCKE HARTLEY HERBART SPENCER BAIN
JAMES WALDEYER BRYAN BOOK WATSON
THORNDIKE PAVLOV BEKHTEREV
KÖHLER WOODWORTH HULL DUNLAP

Can all organisms learn? How does learning take place? How is it studied in the laboratory? What is a learning curve? How do the various kinds of learning differ from one another? Can training in one activity be transferred to another? What are the chief laws and principles of learning?

LEARNING INVOLVES modifying behavior and forming habits. "Learning" is almost synonymous with "living." Consciously or unconsciously all of us learn something new every day—persons, names and faces, news events, where to shop for bargains, or how to use new gadgets. Individual differences, of course, exist; some people learn more in their lifetime and learn it faster than others. The biologist Herbert S. Jennings in a book called the *Behavior of Lower Organisms*, published in 1906, shows that all animals learn, from the lowly amoeba up to man. The amoeba may learn only to avoid eating dangerous food particles, while man learns to extract cube roots, fly in airplanes, or dance the rumba. But both are learning. They differ mainly in degree of complexity.

Early philosophers, despite their interest in education, said little about the learning process itself. Several discussed "association of ideas," but their concern lay more with memory and thinking than with learning as habit formation. An exception was JOHN LOCKE, who noted in the seventeenth century how we tend to associate ideas or objects, a phenomenon similar to what is now called conditioning. He analyzed in remarkably modern fashion how dislikes and fears are inculcated by being associated in one's mind with unfortunate early experiences. For Locke a newborn child's mind is a *tabula rasa*, or clean slate, which receives impressions as he experiences the world about him.

JOHANN FRIEDRICH HERBART, the first actually to write a textbook in psychology (in 1816), made an important contribution to early learning theories. Previously the associationists, as they were called, had treated the human being as a passive creature on whom certain impressions are made. Herbart maintained that one's past experiences, or "apperception mass" as he termed it, have much to do with making new associations and with memories. He also held that most things a person learns tend to cross into his "subconscious," from which they may reappear later. (This was the first foundation of a theory of the unconscious.)

Being a practical philosopher Herbart applied his theories. He had met Johann Heinrich Pestalozzi, the pioneer Swiss educator, and became interested in his plan of building the curriculum around the child's capacities and interests. Herbart established a school at Königsberg and demonstrated among other things that a child can become interested in anything if the necessary preliminary experience (apperception mass) is present. For example, he can understand and interpret a map of Europe if he has learned already how the land, water, and mountains of his own neighborhood are shown on a map. Herbart therefore insisted that school subjects, to be learned effectively and to hold a pupil's interest, should be arranged and presented so that a child can relate new material to material already

learned. Notably by attaching importance to interest and motivation in learning Herbart tremendously influenced education throughout the nineteenth century and gave impetus to founding present-day progressive education.

In 1855 HERBERT SPENCER published his *Principles of Psychology*, introducing evolutionary ideas into psychology even before Darwin's books appeared. Spencer held a biological view. For him life is "the continuous adjustment of internal to external relations." Mind and behavior arise from and depend upon a person's adaptation to his environment. Learning Spencer explains physiologically as an organism's tendency to repeat pleasant acts and avoid painful ones. Increased nervous activity accompanies pleasure, he says; movements that heighten nervous activity and thus increase pleasure are reinforced and repeated. Painful acts, decreasing nervous activity, are eliminated.

Spencer's contemporary, ALEXANDER BAIN, propounded similar ideas on learning and habit, foreshadowing the interpretations of William James and Edward L. Thorndike. In fact, Bain introduced "trial and error," a term still widely used to describe early stages of learning. When we start to form a habit, spontaneous movements or trial-and-error activity occur. Movements having pleasant results are retained and those with unpleasant ones tend to drop out. We learn by repetition: "A few repetitions of the fortuitous concurrence of pleasure and a certain movement will lead to the forging of an acquired connection."

WILLIAM JAMES published his two-volume *Principles of Psychology* in 1890. Probably the most quoted chapter is that on habit. Impressed with the importance of habits in human life, James discusses their neurological aspects, offers several striking examples of their strength, and says:

"Habit is thus the enormous flywheel of society, its most precious conservative agent. . . . It keeps the fisherman and deckhand at sea through the winter; it holds the miner in his

darkness; . . . it protects us from invasion by the natives of the desert and the frozen zone . . . It keeps different social strata from mixing. Already at the age of twenty-five you see the professional mannerism settling down on the young commercial traveler, on the young doctor, on the young minister, on the young counsellor-at-law. You see the little lines of cleavage running through the character, the tricks of thought, the prejudices, the ways of the shop, in a word, from which the man can by-and-by no more escape than his coat-sleeve can suddenly fall into a new set of folds."

Though more philosophical than scientific, James was nevertheless strong for practical applications. The great thing in all education, he insists, is to "make our nervous system our ally instead of our enemy. . . . For this we must make automatic and habitual, as early as possible, as many useful actions as we can." He gives several maxims to help acquire new habits and break old ones. One advises us, when planning to change our behavior, to "launch ourselves with as strong and decided an initiative as possible." Another cautions thus: "Never suffer an exception to occur until the new habit is securely rooted in your life."

James' *Principles* became the standard psychology text, a brilliant finale to the speculative and philosophical tradition. Actually the new experimental movement already had begun. Even before James' book appeared Ebbinghaus published his pioneer studies of memory. Shortly thereafter the scientific study of learning processes began in earnest.

Acquiring Skill

In the closing years of the nineteenth century WILLIAM L. BRYAN and N. Harter at the University of Indiana studied how telegraphy is learned. Testing weekly the progress of students learning to receive and send code, they found that learning takes

place in stages. First the dots and dashes for each letter are mastered. Then the student begins to think of common words as units, without having to spell out each letter. This stage lasts quite a while, then is succeeded by the "sentence habit," in which whole phrases or short sentences are grasped. While one of these so-called "higher units" is developing, a student may seem not to progress, but a period of rapid advancement follows. Apparently in the standstill period the lower order habits are being perfected. When they become automatic, higher units can develop.

A few years later WILLIAM F. BOOK, of the University of Indiana, studied how persons learn to type by the touch method. A sequence of stages similar to those for telegraphy was found. First, the letter position and proper striking are learned. Later, syllables and short word units appear, followed by phrase units. In the copying of skilled typists, however, Book found little evidence of phrase and sentence units. Their eyes looked ahead and they "copied behind" at a regular rate.

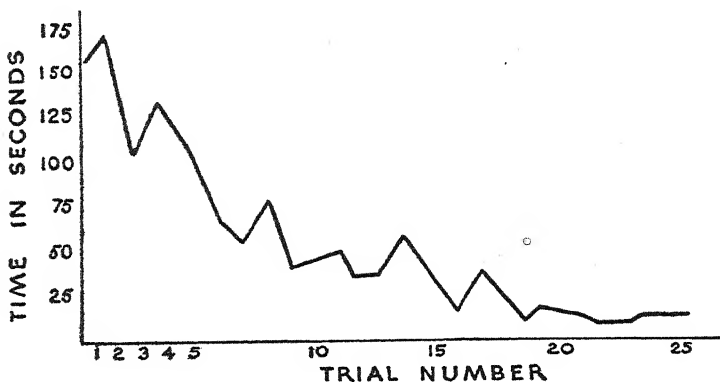
Book also confirmed a fact noted earlier by James and Ebbinghaus—that when students dropped their typing for a period of four months, they picked it up again very rapidly, and without various interfering habits that were present earlier. The typing habits had been established firmly, and therefore persisted, while the annoying practices, accidentally acquired, faded away quickly during the interval.

Animal Learning

After Darwin published his theory of evolution, animal behavior received more attention than ever before. Many physiologists studied animal reflex actions. Other scientists, notably George Romanes and Lloyd Morgan, observed the "instincts" and "intelligence" of animals. Unfortunately much of their data is anecdotal and can not be considered strictly scientific.

EDWARD L. THORNDIKE pioneered in animal psychology, which compares human with subhuman organisms. While study-

ing under James at Harvard in 1897, Thorndike began experiments on learning in chicks. The next year he set up a laboratory at Columbia and continued the work. Not only chicks, but cats, dogs, and monkeys were studied. A hungry cat, for example, was shut in a barred wooden box, and a dish of food placed outside. To get the food the cat had to turn a button or pull a wire loop that opened a door. At first the cat clawed, bit, scratched, and tried to reach through the bars—behavior called “trial and error” by Lloyd Morgan, who took over the term coined by Alexander Bain. In its hit-or-miss struggle, the cat accidentally struck the button and got to the food. Next time, when placed in the box, it found the button sooner. In each successive trial fewer random movements were made, until finally the cat went straight to the button. Graphically, its learning is pictured thus:



While the cat does not improve with perfect consistency, the curve in general declines, rapidly at first, then gradually until it reaches a level at 8 or 10 seconds. Experiments with other animals showed similar results, though monkeys learned faster than dogs and cats.

Thorndike drew important conclusions about animal learning: When driven by hunger, thirst, or other bodily urge, an animal first shows trial-and-error behavior. After some successes learning

occurs, and the useless movements are abandoned. To solve a problem an animal may use movements, or responses, as they are called, that were successful in similar situations. In other words, responses are shifted from one to another stimulus, in the same fashion that an animal learns to do tricks. Thorndike called this behavior "associative shifting." It resembles Pavlov's "conditioned response," described later in this chapter.

Two fundamental laws of learning were postulated by Thorndike—the laws of exercise and effect. The law of exercise holds that repeating a certain act strengthens the bond between stimulus and response, hence makes the response persist. Conversely, disuse weakens the bond. The law of effect is: when an act results in satisfaction or reward, the act is "stamped in"; when followed by no reward or by punishment, it tends not to be repeated.

About 1900 Willard S. Small, of Clark University, began studying how white rats, confined in a maze, learned to find their way out. He initiated what has become the most popular method of studying animal learning. Motivated by hunger, a rat first makes trial-and-error efforts to reach a food box. Once having found the way, the rat on successive trials enters fewer blind alleys, wanders less aimlessly, and finds the box more and more quickly, until the maze is learned. Learning curves similar to those for Thorndike's cats are obtained.

Other psychologists have used the maze to study many problems. JOHN B. WATSON, founder of behaviorism, tried to discover what senses a rat uses in its learning. He concluded that the most essential is the kinesthetic, or muscle, sense. Walter S. Hunter, Norman R. F. Maier, and Isadore Krechevsky built special kinds of mazes to test the higher limits of animal learning and reasoning. Karl S. Lashley used the maze, with other devices, to study the effects of brain operations on rat behavior. William McDougall tried (unsuccessfully) to show that maze learning ability can be passed by heredity to successive generations of rats,

which would prove the inheritance of acquired characteristics.

How humans learn a maze was studied by Harvey Carr, of the University of Chicago, and an associate. They found that blindfolded adults and children do about as well as rats in learning mazes of similar pattern. Fleming A. C. Perrin observed human performance in both outdoor mazes, of the amusement park variety, and stylus mazes, where a blindfolded subject pushes a small rod through grooves in a board. Learning such mazes turned out to be no blind hit-or-miss process; his subjects reported visualizing, planning, and reasoning to find their way out. Somewhat later Carl J. Warden, of Columbia University, and Richard W. Husband, of the University of Wisconsin, determined that human beings use any of three methods in learning a maze: 1) verbal formula ("left one, right three, left two," etc.); 2) forming a visual image of the maze; 3) motor learning, similar to ordinary trial and error. Most effective was the verbal method; least successful, the motor method.

Patterning a test after one of the Army Beta questions, Stanley D. Porteus, of the University of Hawaii, devised several "visible mazes," wherein one traces with a pencil the correct path through a printed maze. To succeed one must look ahead and plan, avoiding impulsive trial-and-error efforts. Porteus and others found that a good performance on these maze tests correlates somewhat with intelligence and "social adaptability."

The Conditioned Response

In 1901 a Russian physiologist, IVAN PETROVICH PAVLOV, discovered something of enormous import to psychology—the conditioned reflex. In effect it is this: If each time a dog is given food a bell is rung simultaneously, the dog becomes "conditioned" to the sound of the bell and in time salivates on hearing the bell, even though no food accompanies it. Not only sounds, but light, smell, or touch stimuli may condition dogs to salivate when no food is present.

The careful experimental methods of Pavlov enabled him to discover many interesting facts. The conditioned reflex results if the conditioning stimulus occurs before or simultaneously with the original stimulus (food). If, for example, the bell sounds two minutes before food is given, a conditioned reflex is set up, the dog inhibiting salivation until two minutes after hearing the bell.

Moreover, a conditioned reflex can be extinguished as well as established. Keep on ringing the bell without presenting food, and the dog ceases to salivate, naturally enough. The conditioned reflex can be brought back in two ways: by "spontaneous recovery" after a lapse of time, and by "reinforcement"—that is, by again presenting food with the bell.

Using the Pavlovian technique psychologists have investigated fineness of sensory discrimination in animals and young children. Pavlov's significant study of "experimental neurosis" by breaking down powers of discrimination was already described in connection with conflict.

Working with children, N. Krasnogorski, a student of Pavlov, found that the salivary reflex, normally occurring when food enters the mouth, can be conditioned to the mere sight of food and also to sounds or even to touches on the skin. An American, Florence Mateer, following up Krasnogorski's lead, in 1916 experimented with many children up to seven years old. By touching a child's arm when a chocolate candy was put in his mouth, she built up a conditioned reflex; in time the child opened his mouth as soon as the arm was touched. Dr. Mateer found that normal children learn to establish and extinguish the response about twice as fast as mental deficients. She decided that conditioning speed is an important indicator of intelligence.

Another American psychologist, Hulsey Cason, conditioned the pupillary reflex. By flashing a light into a subject's eye and ringing a bell simultaneously, he found, after about 400 trials, that the eye pupil contracted to the sound alone. Raymond S.

Dodge, of Yale University, conditioned the winking reflex to the kneejerk by making subjects blink, with a light or a gesture, each time their knees were tapped; eventually subjects winked to the kneejerk alone.

Other investigators showed that it is possible, by appropriate techniques of conditioning, to bring involuntary responses like blushing and the pupillary reflex under voluntary control. Such experiments suggest that there is no hard and fast distinction between voluntary and involuntary action, as is generally supposed.

American psychologists did not learn the details of Pavlov's experimentation until after 1909. Actually it was through the work of another Russian, VLADIMIR M. BEKHTEREV, that conditioning was introduced into this country. Bekhterev's book, *Objective Psychology*, was translated in 1913 and made conditioning the center of his new "reflexology." The foremost American sponsor was John B. Watson, the behaviorist.

Watson at Chicago and Johns Hopkins had insisted for some time that psychology must be hard-boiled and objective. Stimulated by the work of Thorndike and by a group of German biologists known as the "objectivists," Watson had been making intensive studies of animal learning. He eagerly welcomed the work of Pavlov and Bekhterev and seized upon the conditioned reflex as the most satisfactory explanation of learning and habit formation. He also discussed its importance in relation to emotion, language, and even mental disease. His best known experimental work was concerned with the establishing of fears through conditioning, as already described in an earlier chapter.

By 1920 conditioning was widely accepted as an important psychological principle. The Pavlovian "conditioned reflex" was too narrow a concept, however, as not only reflexes but all kinds of responses can be conditioned. Two University of Washington psychologists, Stevenson Smith and Edwin R. Guthrie, suggested instead "conditioned response." They pointed out that this term would then be applicable to all learning by association.

Literally hundreds of experiments have been done upon the "CR," as it is commonly called. Our learning of spoken and written language, our gestures, most of our emotional reactions, responses to various signals—all these are examples of conditioning. Much of our waking lives is given over to making responses which have been conditioned in the course of our past experience.

Are conditioning and trial and error really different kinds of learning? Recently psychologists have sought to harmonize them. One of the best known attempts is made by CLARK L. HULL, of Yale University. Hull insists that all habits are built up by a "reinforcing state of affairs." In conditioning this reinforcement comes, as with Pavlov's dog, from paired presentation of the original stimulus (food) and the conditioned stimulus (bell); the habit learned is salivation at the sound of the bell. In trial-and-error situations, such as a rat learning a maze, reinforcement of an act (taking the right path) results from a successful outcome (getting to food at the exit). Both of these, Hull believes, are examples of the law of effect; they are united by operation of the common principle of reinforcement.

Learning by Insight

Three German psychologists, MAX WERTHEIMER, WOLFGANG KÖHLER and KURT KOFFKA, best known as the founders of Gestalt psychology, objected to Thorndike's and Watson's interpretations of animal learning. Given the right kind of problem, said Köhler, an animal does not necessarily learn by trial and error. If a problem involves "getting the point" or grasping relationships, an animal may solve it as fast as a human being "catches on" to solving a mechanical puzzle. Köhler further argued that learning does not involve merely forming simple stimulus-response bonds, as Watson and the behaviorists implied. It is total reaction to a total situation.

While interned on the Canary Islands during World War I,

Köhler did several famous experiments on apes. He hung a banana from the roof of a large pen, too high for an ape to reach by jumping. In one corner of the pen he left a box. The question was: would the apes get the point of standing on the box to reach the food? Some did. After much leaping, flouncing about, and whining, they would drag the box underneath the banana, mount it, and capture the prize. In another experiment apes used sticks to reach for food. Sultan, the cleverest of the lot, did even better. He tore a branch from a tree, and with it raked in food through the bars of his cage. Another time he joined two bamboo rods to form one long stick, with which he maneuvered food.

While Köhler's animals made trial-and-error efforts, obviously they also perceived relationships, often quite suddenly. Köhler called this quick grasping of relations, or seeing the point, "insight."

More about insight and how it occurs is given in Chapter XVII on Thinking. That insight constitutes learning is best shown by the fact that when a person solves a problem by grasping a principle, he can solve similar problems immediately.

Transfer of Training

Having discussed the three commonest kinds of learning—trial and error, conditioning, and insight—we now turn to the very important question: can learning carry over or transfer to performance in another activity? How much does one kind of training or practice improve another?

In athletics considerable transfer takes place. Coaches insist on calisthenics, gymnasium work, and running to help train their football players. A discus thrower or shot putter develops his arm muscles by lifting weights and swinging Indian clubs.

It is often said that one's mind can be improved through certain studies, much as a muscle is strengthened by exercise. In fact, this argument still is used by those who believe particular

subjects, such as Latin or mathematics, are good "mental discipline." The question has important implications for education.

As early as 1890 William James and his students tried memorizing verses from Hugo and Tennyson, then practicing other poets to see whether such training improved their memory for Hugo and Tennyson. Three of the subjects improved slightly; the other two became worse. James concluded that practice does not affect one's power of retention, though better memory methods may be cultivated.

EDWARD L. THORNDIKE and ROBERT S. WOODWORTH conducted a rather elaborate experiment to test the validity of "mental discipline" in education. They tested subjects' ability to estimate areas of rectangles, triangles, and other geometrical figures. The subjects were then given training that improved their ability to estimate areas of smaller rectangles. This training did not carry over at all consistently when the subjects again turned to triangles and large rectangles. Essentially the same thing resulted when the tasks consisted of guessing weights and lengths of lines, or canceling certain letters and words on a printed page. Sometimes, indeed, practice hindered more than it helped performance in similar activities. Thorndike and Woodworth concluded that training in one kind of activity transfers to aid performance in another only if the two have identical or common elements, such as material worked with, methods used, or attitudes assumed by the subjects.

These findings give small comfort to those who contend that training in one subject improves the mind generally.

Shortly after 1920 Thorndike studied by an ingenious method more than 13,000 high school pupils to see how much each school subject improved their learning power. Mathematics and the social and physical sciences improved it most. Latin, French, and physical training had a slightly positive effect, while stenography, biology, and dramatic art helped not at all. Thorndike points out that the general gain from any subject amounts to little, com-

pared with improvement resulting from the student's own ability.

No one subject can "train the mind" in general. On the other hand, specific transfer value attaches to almost any subject if specified applications are stressed. For example, where the value of neatness is emphasized as students are trained to write neat arithmetic papers, their neatness training carries over to other subjects. Students in a Latin class where special attention was given to word meanings and derivations improved perceptibly in English vocabulary, compared to Latin students taught in the usual manner. Similarly, if principles of scientific method are stressed in a Chemistry course, there is a positive transfer to Physics or Biology.

Negative transfer may also occur. That is, training may interfere with subsequent learning. Linus W. Kline, educational psychologist, found that subjects trained to cancel e's and t's on a printed page had trouble later canceling parts of speech. Negative transfer appears also when subjects, having learned to sort playing cards into one arrangement of boxes, are made to change and sort them in a different arrangement.

Albert T. Poffenberger has shown that if a second task differs greatly from the first, no transfer of any kind results. If responses already learned can be used in the new problem, positive transfer occurs. But if the new problem requires changing previously formed habits, negative transfer or interference follows.

The Neurology of Learning

Almost two hundred years ago DAVID HARTLEY, the first physiological psychologist, suspected that association, learning, and memory have a neural basis. He suggested that when several sensations arouse a certain pattern of "brain vibrations," if one of the sensations recurs later, it calls forth lesser vibrations or memory images of the others. Like John Locke, Hartley believed a child begins life without associations. Through continuous sen-

sory experience, complex connections and associations occur in the nervous system, ultimately making possible the subtleties of adult human behavior.

William James' view, appearing a century and a half later, differed little from Hartley's. The intervening years had seen progress in understanding the structure but not the function of the nervous system. According to James, when we see a person and hear his name, two nerve centers are excited. A neural connection occurs between them, which enables us later to recall the face if only the name is heard, or the name if the face is seen. But James, like the neurologists themselves, was vague about the specific details of neural action.

In 1891, the year after James' *Principles* appeared, W. WALDEYER formulated the "neurone theory" which held that nerve cells, or neurones as he called them, link together or almost together at points called "synapses." (Neurologists still are uncertain whether a synapse is a junction or a small gap.) Synapses retard the progress of neural impulses, which follow the path of least resistance. Learning, Waldeyer said, consists of lowering resistance at some synapses and raising it at others, resulting in new neural pathways or patterns.

A few neurologists have expanded Waldeyer's neurone theory, notably Sir Charles S. Sherrington, whose *Integrative Action of the Nervous System* in 1906 described many details of neural function at the synapse. But essentially the theory has not changed for fifty years. The real nature of the neural impulse and of the specific processes occurring at the synapse remain a mystery.

Theories of Learning

Ever since Thorndike postulated his "laws of learning" psychologists have speculated and argued about just how learning occurs. According to the law of exercise, actions most often and most recently repeated are learned. Thorndike had noted that the

movements a cat makes oftenest in escaping from a problem box are incorporated into the final habit. Though widely accepted as an interpretation of learning, this law has been criticized sharply. We give but one example.

KNIGHT DUNLAP, formerly of Johns Hopkins University, found he had an annoying habit of writing "hte" on his typewriter instead of "the." Astoundingly enough he corrected the error by deliberately writing "hte" several hundred times, all the while telling himself this was the mistake he wished to correct. Dunlap and others have used this technique rather successfully to cure thumb sucking, nail biting, and stuttering. Apparently a person's intent can be strong enough to offset even much repeated exercise.

Thorndike's law of effect fares better as a general theory of learning. It states that those acts are learned which are accompanied by satisfying consequences, while those acts are eliminated which are accompanied or followed by an annoying state of affairs. Some objections to the law have been raised, but it is impossible to disprove the fact that the effects of our actions determine largely which shall be retained and which eliminated. JOHN A. MCGEOCH in his recent *Psychology of Human Learning* concludes that the law of effect is one of the most general and important in the field. We have already discussed Clark Hull's attempt to reconcile conditioning and trial-and-error learning on the ground they are both examples of the law of effect.

Less theoretical than laws of learning are the characteristics of effective learning. The following summary is adapted from a widely used textbook of psychology written by JOHN F. DASHIELL of the University of North Carolina:

1. The subject must be motivated. A well-fed rat may fall asleep at the entrance to a maze, but a hungry rat explores and eventually finds his way through it. A

high school student striving to win a college scholarship usually does better work than his classmates.

2. The motive is obstructed. If given food at the entrance to the maze, no learning occurs. Learning takes place when one finds ways to circumvent obstructions, to discover proper means to ends desired.
3. The subject shows random and varied activity, such as occurs in learning to type or drive a car, or as shown in most of the animal experiments.
4. Successful responses come mostly by chance. In learning by trial and error or conditioning the subject can not predict right responses in advance. He "hits upon them" accidentally.
5. Effect determines the selecting and fixating of right responses. When an act leads to the goal and thus brings about satisfaction, it tends to be repeated.
6. Learning may come about rapidly or may take a long time. When insight occurs, there is sudden improvement; with trial and error and conditioning, progress is more gradual.

CHAPTER XV

Remembering and Forgetting

PLATO ARISTOTLE HARTLEY BROWN
MILL HAMILTON HERING JAMES
EBBINGHAUS McGEACH FREUD ZEIGARNIK
JENKINS DALLENBACH MÜLLER JOST
GATES BALLARD ENGLISH BURTT



How are remembering and forgetting related to learning? What scientific methods and devices are used in studying memory? How is memory affected by emotion? By motivation? By sleep? What are the most effective methods for retaining what we have learned? Can memory be improved?

MEMORY IS A PHASE OF LEARNING. Broadly speaking, learning has three stages: 1) acquiring, wherein one masters a new activity like driving a car, or memorizes verbal material such as a poem; 2) retaining the new acquisition for a period of time; and 3) remembering, which enables one to reproduce the learned act or memorized material. The commonest forms of remembering are recalling and recognizing. Forgetting signifies either failure to retain or inability to recall or recognize.

In a narrower sense learning merely means acquiring skill, as with mazes, problem boxes, and conditioned responses. Most of

these are muscular, non-verbal activities. With remembering and forgetting we deal mainly with verbal activities.

Historical Background

Many philosophers have considered memory in discussing association of ideas. PLATO noted that we associate by contiguity. The sight or sound of a lyre may call to mind the instrument's player or his friend, because previously they were experienced together. Plato mentioned also that a person or object may recall a like person or object, a process later called association by similarity. ARISTOTLE wrote that recall takes place through suggestion. One item causes us to recall another because the two once were contiguous, or because they are similar to or opposite from each other. DAVID HARTLEY, an eighteenth century Englishman, stated that there are two sorts of association, the synchronous and the successive, according to whether impressions are made at the same instant or in successive instants. We already have mentioned Herbart's theory that association and memory are influenced by a person's "apperception mass" or sum total of past experience.

THOMAS BROWN, a noted Scottish philosopher, drew up in 1820 several principles of association that contributed significantly to existing theories of memory. We associate and remember, said Brown, according to the relative duration, liveliness, frequency, and recency of original experiences. He suggested also that temporary abnormal conditions like intoxication or delirium affect the way we associate and remember. Brown's principles antedated theories of learning that appeared nearly a century later.

In his *Analysis of the Phenomena of the Human Mind*, published in 1829, JAMES MILL reduced all the laws of association to one—contiguity in experience. Memory in the form of recognition is an idea or image of an object plus awareness of our earlier experience with it. Mill's contemporary, SIR WILLIAM

HAMILTON, protesting against oversimplified theories of association, introduced "redintegration." One impression, he said, evokes not a *single* associated idea but the *whole situation* of which both formerly were a part. Our experiences are complex and contain many elements; any one element later may redintegrate or recall the total earlier experience. Almost a century later Hamilton's theory of redintegration was developed and expanded by Harry L. Hollingworth.

EWALD HERING, a great nineteenth century German physiologist, stressed the physical and neurological basis of memory. Any perception causes a certain neural process or path in the brain. Recurring, this perception follows the same neural path, bringing about the experience of memory.

WILLIAM JAMES held that each person has a certain power of retentiveness, its quality depending on his brain structure. Agreeing with Hering that any act of memory involves a certain neural pathway, James doubted that learning one thing can aid in learning another because the two neural bases differ. After studying transfer in memorizing poems, he concluded as we have seen, that one's retentiveness cannot improve by training.

The Work of Ebbinghaus

An amazing monograph called *Memory* revealed in 1885 what HERMANN EBBINGHAUS, a brilliant German, learned from studying himself for five years. Few pieces of research are as original. Influenced by Fechner's psychophysics and by new statistical methods, Ebbinghaus devised new materials and procedures and explored aspects of memory never touched before. For a generation afterwards few students found a memory problem not already investigated by Ebbinghaus.

The sections which follow contain the more significant findings of Ebbinghaus and his successors in each of the major areas of memory research. They are presented in an order which empha-

sizes first, memorizing; second, retaining and forgetting; third, reproducing or remembering.

Importance of Meaning and Rhythm

To get memory material free from past associations Ebbinghaus invented and used nonsense syllables. These are meaningless—or almost meaningless—combinations of three letters, such as rof, bap, tid, guk. Over 2,000 such syllables exist in German and almost as many in English. (Later investigators find four-letter syllables, such as jish, fape, thog, and crad, even more satisfactory as they produce fewer associations and are easier to pronounce.) By this means it is possible to make accurate study of rote learning; also to compare the ability of different individuals, since none are familiar with the materials.

Ebbinghaus compared his speed in memorizing lists of nonsense syllables with his speed for meaningful material. Certain stanzas of Byron's *Don Juan*, each having 80 syllables, took him about 9 readings each to learn. Eighty nonsense syllables required almost 80 repetitions. In other words, meaningless material was nine times as hard to learn as meaningful.

Ebbinghaus thought that rhythmic grouping of syllables might affect his memorizing. Hence he used a constant rhythm in all his learning, though he did not study the effects of rhythm. GEORGE E. MÜLLER, a German contemporary of Ebbinghaus, found that grouping syllables into units of two and three or even six helped learning considerably. However, one type of rhythm is not necessarily best for all persons, because individual differences are great.

Length of Lists

If a memory task is made longer, does its learning time increase proportionately? Does it take twice as long to learn 20 lines of poetry as to learn 10 lines? Ebbinghaus found he could learn seven or eight nonsense syllables by reading them once. To learn 10 syllables required 13 readings. The time required for

each new item and for the whole list increased disproportionately. His findings appear in the following table:*

LENGTH OF LIST	NUMBER OF READINGS	TIME FOR LISTS	AVERAGE TIME PER SYLLABLE
7	1	3 seconds	.4 seconds
10	13	52	5.2
12	17	82	6.8
16	30	196	12.0
24	44	422	17.6
36	55	792	22.0

Later studies report the same general results, though time taken usually is longer. No very consistent mathematical relation between length of list and learning time is found. Clearly, more associations require much more time per unit. Often, however, familiarity with the material compensates for increased length.

Overlearning

Is a selection learned when we first recite it once correctly, or when we "know it by heart"? Ebbinghaus's criterion of learning was one perfect recitation of the list. To test overlearning, i.e., learning more than is required for one correct recitation, he varied the number of readings given to lists of 16 nonsense syllables. Some lists he went over 8 times, some 16, and so on up to 64. At the end of 24 hours he relearned the lists up to one correct repetition, and found that the percentage *saved* corresponded almost exactly with the number of times he had originally read the material. Where he read a list 8 times he found 8% saving; 24 times, 23% saving; and 64 times, 64% saving. Undoubtedly a point of diminishing returns would have been encountered, if Ebbinghaus had continued above 64 repetitions.

Other studies have on the whole substantiated Ebbinghaus's results, though there is doubt about the amount of overlearning which is profitable in terms of savings later. The consensus of opinion seems to be that retention is increased by overlearning up to 50%; that is, spending 50% more time memorizing material

*From Garrett, Henry E.; *Great Experiments in Psychology*, 1941, p. 262.

than is required for one correct repetition. Overlearning beyond that point, except when spaced over several days, may involve inefficiency due to wandering attention, boredom, and fatigue.

Spaced and Unspaced Learning

As might be expected, Ebbinghaus found that memorizing a large amount of material all in one day took considerably more effort than memorizing it over several days. Others report the same. William F. Book, studying how we learn typing, found it better to distribute his practice periods. Karl S. Lashley discovered that best results came from spacing the learning trials. He found also that rats learning a maze repeat errors more frequently when trials are bunched than when they occur a day apart. Robert M. Yerkes, the animal psychologist, noted that his dancing mouse learned to discriminate white from black faster when few rather than many trials were given the same day.

Two factors are involved in spacing learning periods: length of the learning period, and the interval between periods. Warden studied both in animal maze learning. He gave his rats 1, 3, or 5 trials at a time; the intervals between varied from 6 hours to 3 days. Results showed clearly that one trial at a time, given at intervals of 12 hours, made for best acquisition of the habit.

Clearly, distributed learning is better than concentrated learning, but no general optimum length of practice period or interval between periods is found. Warden's findings do not hold for a pupil studying French. There are not only differences between the animal and human species, but also among individuals. Likewise considerable variation in kind and difficulty of learning material is encountered. When material is easy, and when interest and motivation are high, massed learning is most effective. Where the task is difficult, when interest lags and boredom or fatigue sets in, distributed learning periods are best. Practically, a student must experiment on himself to find the most effective length for his study periods and for rest intervals between.

Whole versus Part Methods

Is it better to learn a poem one stanza at a time, or to go through it at each reading from beginning to end? Most persons prefer the stanza by stanza method, yet the majority of experiments show the other to be more efficient. One study showed that the whole method took 12% less time; another found it had a 15% advantage over the part method. Nonsense syllables, prose, poetry and vocabulary generally are learned best by the whole method. Mazes are not, either by animals or humans; sometimes the part method is better, though more often the two approaches seem about equally effective. In his *Psychology of Human Learning* JOHN A. McGEACH says if a subject's level of mental development is high, the whole method probably is better. When practice periods are massed, the part method wins; when distributed, the whole method. Meaning and unity in the material, as in poetry or connected prose, favor the whole procedure.

Variations of whole and part methods are possible. In the "progressive part method," a subject learns part 1, then part 2, then ties them together; next part 3, then connects 1, 2, and 3, and so on. Louis A. Pechstein found this technique best in memorizing nonsense syllables.

Robert S. Woodworth says that a learner prefers working with parts and may gain skill with them which carries over to other sections of the problem. But he still must put the parts together. If he can adjust himself to the whole method, it will serve him best in complex learning tasks. Probably it is best, concludes Woodworth, to start with the whole method, feeling free to concentrate at any time on the parts.

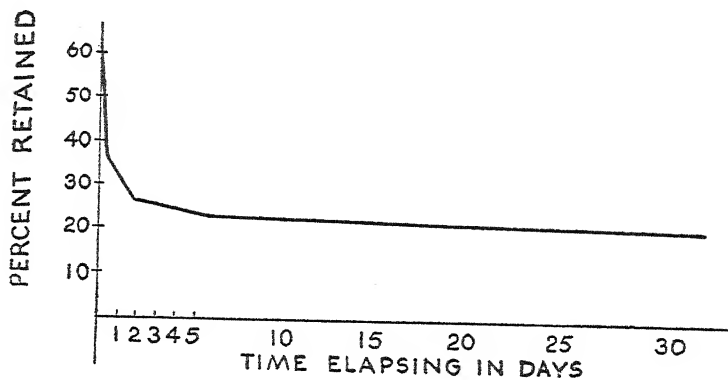
The Curve of Forgetting

How fast does forgetting occur?

Ebbinghaus memorized lists of nonsense syllables, waited for a certain period of time, then tested his retention by the "savings

method." This method, one of his ingenious inventions, consists of relearning material and calculating the percentage saving of time as compared with original learning time. In this experiment, for example, it took him about 24 minutes to learn 16 lists (up to a standard of two correct repetitions). An hour later he took only $13\frac{1}{2}$ minutes to relearn the same lists. The difference between 24 and $13\frac{1}{2}$, expressed as a percent, is the saving—in this case 44%.

Ebbinghaus found that most of the loss comes in the first few hours; after that forgetting proceeds very gradually. After one hour he forgot 56%, after nine hours, 64%, after two days, 72% and after 31 days, 79%. In graphical form, the curve of forgetting (or, more accurately, the "curve of retention") looks like this:



Results of many similar experiments, with materials ranging from nonsense syllables to high school Latin and algebra, agree with those of Ebbinghaus, though the precise form of the curve of forgetting depends largely upon the method used for testing retention. The savings method, as shown above, shows a quick drop at first, then a very gradual decline. When memory is tested by making the subject *recall* material, rather than *relearn* it, the curve of forgetting is found to fall off sharply for two days or more before it flattens out. But whatever the method used for

testing memory, it still holds true that most of our forgetting takes place in the first day or two after we learn.

Attitude of the Learner

Passage of time alone does not cause forgetting. Our retention of material is affected by a number of factors, which will be treated in this and the following sections.

To memorize efficiently and retain the memorized material, we need an active interested attitude, with intent to learn. Woodworth describes a student who seemed very slow at learning non-sense syllables. Asked if he was ready to recite the list, he exclaimed: "Oh! I didn't understand I was to learn them." He had noted the syllables separately, but made no effort to connect them.

Joseph Peterson found by experiment that a subject's intent to learn, compared with mere passive observation, caused a real advantage in retention two days later. Hermann H. Remmers and an associate discovered that a mental set to retain for three days, one week, and two weeks, consistently aided recall at each of these intervals.

Though learning occurs even without a "will to learn," it is sketchy and untrustworthy compared with learning where maximum attention and motivation are present.

An interesting theory of memory is proposed by BLUMA W. ZEIGARNIK, a student of Kurt Lewin. She gave a large number of subjects 20 puzzles and similar problems to solve. They were allowed to work on half the problems until completed; in the other half they were interrupted before they could finish. When later asked to recall as many problems as possible, they remembered considerably more of the unfinished ones. Dr. Zeigarnik concluded that unfinished tasks leave a tension or dissatisfaction because a desire to solve the problem is frustrated. Hence we remember them better than the completed tasks where tensions are relieved.

Emotion and Memory

Emotion affects both learning and memory. Inaccuracies found in the testimony of witnesses result partly from emotional factors operating at the time of accidents or other dramatic incidents.

The best known theory of how emotion influences memory is that of SIGMUND FREUD. Freud explains forgetting in terms of repression. Because we repress the unpleasant we forget ideas or incidents associated with it. He gives as an example forgetting the names of persons we dislike.

Two experiments to test Freud's theory were done by Hyman Meltzer and by Ross Stagner. They studied how well college students remember pleasant and unpleasant experiences. More pleasant than unpleasant items were retained, though the difference averaged only 10% or 15%. In fact, a good-sized minority of subjects forgot pleasant items more than unpleasant ones. In general, repressing the unpleasant probably explains some of our forgetting, as Freud believed, but by no means all of it. A more tenable theory, proposed by several psychologists, is that both pleasant and unpleasant emotional experiences are retained better than experiences having no emotional value.

Sleep and Forgetting

A surprising discovery is that we do not forget something newly learned as quickly if we sleep right after learning it as we do if we remain awake. JOHN G. JENKINS and KARL M. DALLENBACH compared the effects of sleep and of waking activity on newly learned nonsense syllables. A much greater loss occurred during the waking interval than during sleep, particularly after four hours. After eight hours' sleep retention was as good as after two. Jenkins and Dallenbach interpreted this to mean that forgetting is caused largely by interference from new experiences, rather than by the mere passing of time.

Retroactive Inhibition

Remembering a newly learned poem may be interfered with if a second poem is learned right away. Forgetting caused by subsequent activities is called "retroactive inhibition."

In 1900 Georg E. Müller and Alfons Pilzecker, two German investigators, found that subjects recalled 56% of learned material after an interval of idleness, but only 26% when the interval was occupied by mental tasks.

If two learning tasks are similar they interfere with each other more than unlike tasks, John A. McGeech reported. Students find this true when they study Spanish right after studying French. Learning and remembering the French is hindered more by the Spanish than it would be by Physics or Mathematics. Following a period of learning with sleep is best; next best is relaxation or complete diversion such as listening to music. According to McGeech, other ways to retain material despite retroactive inhibition are to learn it completely, and to widen the interval between the original and the interfering activity.

Relearning and Review

To see what effect periodic reviewing or relearning has on material to be remembered, Ebbinghaus learned lists of nonsense syllables and also stanzas of Byron's *Don Juan*. Then he relearned both every day for six days. Each successive day required less reviewing to repeat the lists perfectly once. This suggests that associations once formed become stronger as time goes on. The principle was formulated as a law by ADOLPH JOST, another student of memory. Jost's Law reads as follows:

If two associations are of equal strength but of different ages, the older one will lose strength more slowly with the further passage of time.

For permanence of retention, then, frequent relearning and review are essential, as most actors and teachers well know.

If we actually recite memorized items to ourselves, we remember them much better, ARTHUR I. GATES, of Teachers College, Columbia University, showed. In learning both nonsense syllables and material that made sense, one group of pupils studied by reading only. Another group read for 80% of the time and spent the remainder reviewing orally. With other groups the proportion of reading and recitation time was varied. Results showed clearly that the most efficient retention occurred when most of the time was given to review and recitation. In fact, the best proportion usually was 20% reading to 80% recitation. Students would profit by spending less study time in reading and more in reviewing and reciting to themselves.

Self-recitation has several advantages. It encourages concentration. It makes the learner notice his errors, which usually go undetected when he reads. It leads him to organize material for convenient use later, such as an examination or oral classroom recitation.

Reminiscence

A mysterious quirk of memory is "reminiscence," the ability to recall *more* instead of *less* as time elapses. In 1913 an English psychologist, PHILIP B. BALLARD, noted that a group of 6-year-olds who studied poems for 15 minutes recalled more several days later than they did immediately after learning! This was not true for adults, nor was reminiscence apparent for meaningless material. HORACE B. ENGLISH and associates at Ohio State University found reminiscence operating when subjects recalled substance or meaning, but not when they recalled material verbatim. Reminiscence occurred up to two months after the learning. Reminiscence apparently is not due to review in the period between learning and recall; as yet no satisfactory explanation exists.

Recall and Recognition

"Recall" and "recognition" are the best known methods of testing retention. Recall means reproducing material as learned, as when one writes out or recites a poem. But a once learned poem which cannot be recalled may be recognized when one comes across it in an anthology. Recognition means awareness of a previous experience, or a feeling of familiarity. Generally it is easier than recall. Edith M. Achilles found that two or three times as many nonsense syllables, words, and proverbs can be recognized as can be recalled.

Errors of both recognition and recall are common. Woodworth lists several names mistakenly recalled: McDonald for McDougall, Hennessy for Haggerty, Ernst for Stern, Barclay for Clayton, Underwood for Overstreet. Errors of recognition sometimes are puzzling: we feel certain we already have met a person to whom we are introduced. Walking in a strange city we suddenly have a conviction that we have been there before. Harry L. Hollingworth explains such instances by the principle of redintegration: a part of the new experience, having been present also in a past experience, calls to mind the past experience and with it a feeling of familiarity or recognition.

The Savings Method

Though not as well known as recognition and recall, the most accurate way to measure memory is the relearning or savings method, devised by Ebbinghaus. We may be unable to recall or even recognize poems learned years ago, but if we memorize the same poems now it takes less time than learning completely new poems of the same type. This happens because imperceptible memory traces have lasted over the years.

An almost unbelievable instance of these traces is evidenced in an experiment performed by HAROLD E. BURTT, of Ohio State University. When his son was about two years old, Burtt read

him Greek passages daily for three months. When the boy was eight and a half years old, his father made him learn several Greek selections, including those which he had heard more than six years before. Between one fourth and one third *fewer* trials were needed to learn the passages heard by the two-year-old than to learn the completely new material! Never has an experiment shown so clearly both the impressionability of babyhood and the lasting character of memory traces.

Memory Improvement

The many studies reviewed above bristle with practical implications. Remembering is aided by meaningfulness of material, by overlearning, by spacing periods of study, and sometimes by using the whole rather than the part method of attack. Most forgetting takes place in the first couple of days after learning. One's power of retention cannot be increased, but memory may be improved by active attention to the learning task and by adoption of a favorable interested attitude. Retention is aided by sleep, relaxation, or change in activity right after learning. Frequent review and self-recitation helps to fix material firmly in mind. It may be true that every experience leaves a permanent memory trace, but these can seldom be detected by the usual methods of recall and recognition. They may be brought to light by the relearning or savings method.

CHAPTER XVI

Perceiving

DA VINCI DESCARTES BERKELEY HAMILTON
HELMHOLTZ WUNDT TITCHENER CATTELL KÜLPE
JAMES PILLSBURY WOODWORTH CARMICHAEL
WERTHEIMER KÖHLER KOFFKA MORGAN



What is attention? How is it attracted? What causes distraction? Why is "mental set" important? How does perceiving differ from sensing? What is Gestalt psychology? What are optical illusions and how do they occur? How is it possible for us to perceive depth or distance?

IN A PSYCHOLOGICAL SENSE the word *perception* means both the physical act of receiving sense impressions (seeing, hearing, smelling, etc.) and interpreting these impressions. To perceive accurately we must first of all have good sense organs. We must also "pay attention." Our past experience and present mood affect perception considerably. For example, different persons "perceive" symphonic music very differently. A deaf person hears only the loud instruments. A musically trained person hears intricate figures, counterpoint, subtle variations. To an unmusical person the performance is only a jumble of sounds. A weary person slumbers through many passages, while someone seated nearby is moved with deep emotion.

Though individuals vary greatly in what and how they perceive, several phenomena of perception are found to be much the same for most persons.

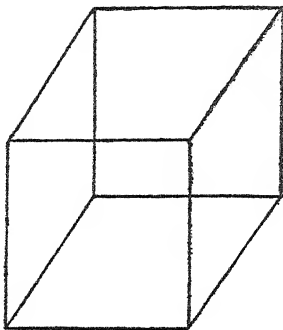
Span of Attention

A hundred years ago SIR WILLIAM HAMILTON noted that six or seven separate objects, such as marbles, can be seen clearly at one time. William S. Jevons, well-known British economist and student of logic, shortly afterwards experimented on attention. He threw beans into a small flat box, trying to estimate how many were there as soon as they landed. With 3 or 4 beans he made no errors; with 5 only a few errors. Even with 8 or 10 beans his first glance gave the correct number about half the time.

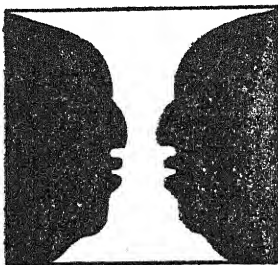
These early studies of how many objects we can see clearly at a glance, called "attention span," later were confirmed by JAMES McKEEN CATTELL and others, using more accurate laboratory techniques. Adults apprehend from 6 to 11 objects at a time, averaging 8. If items occur in groups of 3 or 4, many more than 8 can be caught in the immediate span of attention. Cattell found that a subject can note as many as 30 letters in a fraction of a second if the letters make up a meaningful short sentence. Apparently the number of units matters less than the organization of units.

Fluctuations and Levels of Attention

A German scientist, V. Urbantschitsch, discovered that a watch, placed at a point where its ticking just barely can be heard, alternates between being heard and not heard. A similar oscillation or fluctuation of attention was noted by a Swiss naturalist, L. A. Necker. Sometimes when he observed this diagram of a cube, one surface seemed to be the front; suddenly the cube appeared to shift and another side became the front.



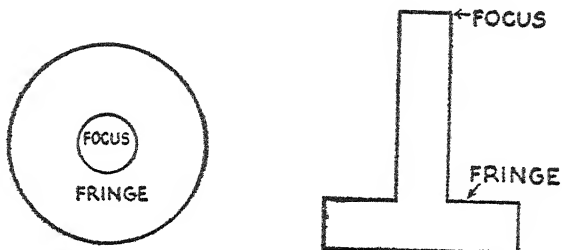
Edgar J. Rubin, Danish psychologist, proved the same true of what he called an "ambiguous" figure:



Sometimes one sees a white goblet, then the figure becomes two faces.

WALTER B. PILLSBURY of the University of Michigan asked subjects to look at a small ink dot, and to press a key when their attention wandered or changed. Their attention fluctuated every second or two, on the average; apparently it could not remain absolutely unchanged for more than a very few seconds.

When we "pay attention" to something we bring it to the focus of our consciousness; everything else is relegated to the fringe or margin. Both WILLIAM JAMES and EDWARD B. TITCHENER stressed this contrast between focal and marginal consciousness. The focus, Titchener said, is a high level of attention, the fringe a low level. He illustrated the point with these figures:



Titchener's pupil, Ludwig R. Geissler, found more than two levels of attention in many persons. Some of his subjects reported they could distinguish three or even more.

Interference and Distraction

Alfred Binet and other early psychologists discovered that two simultaneous activities interfere with each other unless both are extremely easy, or very similar in nature, like patting the head with one hand and the stomach with the other. Apparently we can attend to but one thing at a time. Dictating several letters "at once," or playing ten chess games simultaneously, is possible because attention may alternate rapidly from one item to another.

The best known distraction study was made by JOHN J. B. MORGAN. Subjects learned to punch keys, corresponding to a certain code, on a kind of typewriter. As the subjects punched, bells, buzzers, and other distractors were introduced. These slowed up work, but the subjects soon overcame the noise distractions. Later when the noises ceased, a slump resulted. Momentarily quiet became a distractor! Morgan found also that during distraction the keys were struck harder, and that subjects tended to speak the letters as they worked as if it aided them to overcome distraction.

How distractions affect business and industrial workers was studied by Donald Laird, of Colgate University, Horace M. Vernon, and others. They showed that sudden or unexpected

noises distract much more than continuous sounds; also that stimuli with meaning, like a radio speech, distract more than meaningless noises such as the subdued roar of street traffic.

What Attracts Attention

Important among the factors that compel attention, as first noted by Titchener and his students, are size, motion, color, repetition and, in general, any stimulus that contrasts sharply with its background. These are first principles for advertising men. Analyzing advertisements, Howard K. Nixon, of Columbia University, found that the bigger an "ad" is, compared to neighboring ones, the more it attracts. Daniel Starch demonstrated that color pages of advertising draw almost twice as much attention as black and white pages. That ample white space surrounding an advertisement enhances, by contrast effect, its attention value was noted by Edward K. Strong, of Stanford University.

Mental Set

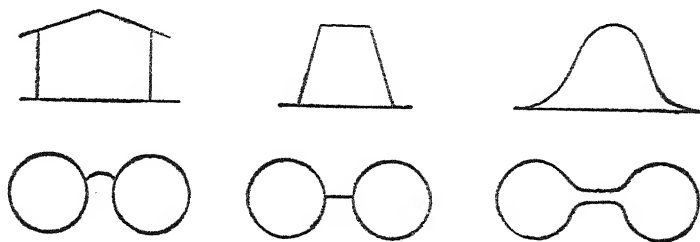
Cattell and others discovered that our attitude or expectation influences the speed of our reactions. If we concentrate on the response we must make when we see a light, we react faster than if we fix our attention on the light itself.

How our attitude or "mental set" affects behavior was observed by Narziss Ach, German psychologist. Studying reaction time he found that subjects reported a period of preparation or "getting set" before the stimulus was given. When the light or bell signal was presented, the response followed almost automatically. Henry J. Watt, an English psychologist working in Germany, discovered that mental set operated similarly in the controlled association test. When a subject is told to "give the opposite" of each word named, he adjusts himself beforehand by thinking of a few examples or perhaps by making gestures. If the word "high" is then given, he responds "low" quickly and

without effort. His mental set has prepared him for an efficient response.

OSWALD KÜLPE, a graduate of Wundt's Leipzig laboratory, found that a specific intention to learn nonsense syllables resulted in twice as much actual learning as a mere general observation of the syllables; and subjects do not learn the serial order of nonsense syllables unless specifically directed to, Georg E. Müller and Friedrich Schumann, two other German experimenters, found.

Recently LEONARD CARMICHAEL, president of Tufts College, and two associates demonstrated how mental set influences perception. Subjects were shown, briefly, several figures like those in the center below. If told the figures resembled a beehive and eyeglasses, they tended to see those objects and reproduced them as shown on the left. If told they resembled a hat and a dumbbell, they reproduced what appears at the right.



Apparently a mental set can influence the way a subject perceives a stimulus and the way he remembers it.

Among American psychologists ROBERT S. WOODWORTH probably stresses most the importance of mental set in behavior. He considers "set" a highly selective and active process that favors some responses and prevents others. He distinguishes between "preparatory set," in which we adjust ourselves beforehand to make a certain kind of response, and "continuing set," which steers activity already going. A runner awaiting a starting gun or a motorist at a stoplight show preparatory set. A speaker seeking the right words to express his thoughts illustrates continuing set.

Attitudes of readiness doubtless have bases in the brain and nervous system, according to Woodworth, though such bases are hard to discover experimentally.

Early Theories of Perception

An eighteenth century Scottish philosopher, THOMAS REID, distinguished between sensation and perception. His distinction carried over into modern psychology. Sensation, he said, occurs when a sense organ like eyes or ears receives a stimulus. Perception involves sensation, but includes also knowledge of the object perceived and awareness of its existence. A certain stimulus produces *sensations* of redness, roundness, and pleasant odor. But what we *perceive* is a rose.

An important function of perception, Thomas Brown added, is grasping relationships. When two objects are observed together, we perceive similarities or differences between them in size, color, and quality.

WILHELM WUNDT believed that perceptions combine or fuse together a number of sensory elements. Each percept has unique characteristics. Just as hydrogen and oxygen combine to form water, which has properties not found in either component gas, so a percept resulting from several sensations is a new psychological product, or "creative synthesis." This theory resembles John Stuart Mill's earlier idea of "mental chemistry."

William James agreed with Wundt that a percept is more than its component sensations. But he went a step farther in insisting that it cannot be analyzed into them.

James' view was supported by CHRISTIAN VON EHRENFELS, German philosopher and psychologist, who introduced the idea of "form-quality." The form-quality of an object is, in effect, the relationship of all its parts which combine to make up the whole that we see or hear. For example, the form-quality *squareness* depends on the relationship or pattern of its four lines, not on any line separately. This again shows that perception is not a

mere sum of sensations, but a new product. Ehrenfels noted temporal as well as spatial form-qualities. The best instance is a musical melody, a pattern of sounds made by combining many separate notes. If the notes are all transposed into another key the melody remains, showing the same form-quality.

Gestalt Psychology

The notion that perception involves much more than sensation or even combined sensations was clarified and verified experimentally by MAX WERTHEIMER, founder of the school of Gestalt psychology.

About 1910 he discovered that two slits in a screen, lighted up a fraction of a second apart, produced an effect of movement. The light seemed to move from one slit to the other, though no actual movement took place. (Moving pictures are based on this illusion of movement. Actually nothing moves on the screen; we see a rapid succession of slightly differing still pictures which our eyes interpret as movement.)

Impressed by this experimental evidence that perception includes more than is found in separate sensations, Wertheimer and his colleagues WOLFGANG KÖHLER and KURT KOFFKA continued experimenting and, as a result, built up the school of Gestalt psychology. "Gestalt" is one of those German words that defies translation. "Form," "figure," "pattern," and "configuration" have been suggested; none is quite right. So "Gestalt" carries over, as is, into English.

Gestalt psychologists hold that every experience is an unanalyzable whole that cannot be understood by breaking it down into parts. The whole is more than the sum of its parts. A landscape is not merely grass plus trees plus sky plus clouds plus other details. It is a distinct percept or experience, with a quality all its own. One may note parts of the whole, but the parts exist in definite relationships to each other. Disturb the relationships and the quality of the whole changes.

To show that perception of relationship is important Köhler conducted an ingenious experiment with hens. Grain was placed on both white and gray pieces of paper. If a hen pecked at grain on the gray paper, she was permitted to eat. When she pecked at grain on the white paper she was shooed away. After several hundred trials the hens learned to peck only from gray paper. Then Köhler substituted black for the white paper. Would the hens still respond to the gray paper, to which they were conditioned? In almost three-quarters of the trials the animals approached the black rather than the gray paper. In other words they had learned to respond to the relation "darker than," not merely to the gray paper as such. Relationship between light and dark dominated the animals' perception.

Among other relationships commonly perceived, Köhler and Koffka noted that figure and background occur frequently. When we perceive a thing, some aspect of it stands out rather clearly. A figure emerges against a vaguer, more diffuse background. In a symphony the melody is the figure, the harmony and accompaniment are the ground. Sometimes the figure and ground alternate, as in the sketch on page 226 of a vase and two faces. A small boy at the zoo confused figure and ground when he looked at the zebra and said: "Mama, is that a white horse with black stripes, or a black horse with white stripes?"

An interesting principle found by Gestaltists is that we tend to close in or complete an incomplete figure. They call this "clo-

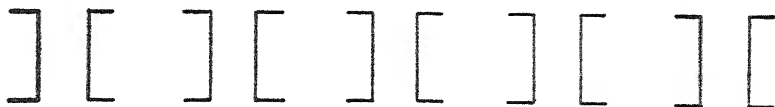


sure." The figures above we perceive as a circle and a triangle, though actually they are not.

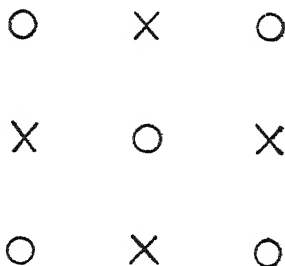
Unconsciously we fill in the gaps and perceive complete figures. We are likely also to establish groupings or patterns in a uniform series of items. Sounds, for instance, are heard in twos, threes, or fours. This grouping tendency, as Wertheimer showed, is helped by proximity, similarity, or other cues.



In the figure above we see five pairs of parallel lines. In the figure below, however, we are likely to see four boxes in the middle. The short horizontal lines give this effect:



In the following figure we probably see a diamond formed by the small crosses, and a large cross formed by the circles:



Gestalt psychologists demonstrate clearly that each of our perceptions is a unique pattern of relationships, a unitary experience with qualities and properties of its own. It is a whole greater than the sum of its parts; it can not be broken up and analyzed without altering the nature of the experience. These principles are the Gestaltists' greatest contribution to psychology.

Optical Illusions

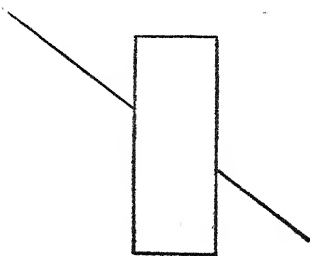
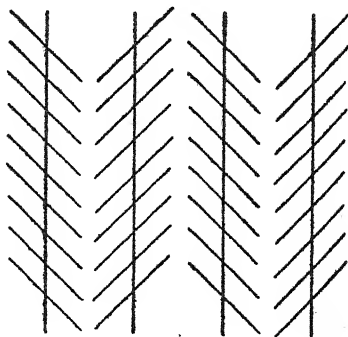
An illusion is a false or distorted perception. Psychologists of the late nineteenth century noted and tried to explain several common illusions.

Wilhelm Wundt observed that we tend to overestimate vertical compared with horizontal distances. In the following figure the vertical line seems longer than the baseline:



Actually they have the same length. Wundt explained this illusion by eye movements; eyes move vertically less often and with less ease than horizontally. Hence a one-inch vertical span seems longer than the same span horizontally.

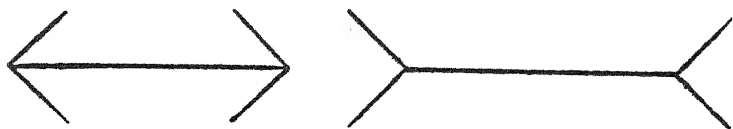
J. C. Poggendorff and F. Zöllner designed figures to illustrate illusions of direction.

*Poggendorff**Zöllner*

In Poggendorff's figure the lower part of the diagonal line seems not to be a continuation of the upper part. Actually it is.

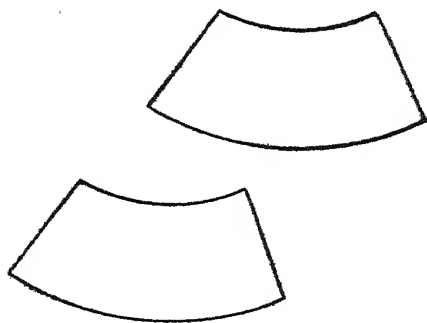
In Zöllner's figure the verticals appear to converge or diverge. In reality they are parallel. A generally accepted explanation of these illusions is that we tend to overestimate the size of small angles and to underestimate the size of large ones. This affects the apparent direction of lines forming the angles.

The famous illusion of F. C. Müller-Lyer, another German psychologist, wherein the line of the right-hand figure appears longer than the line of the left-hand figure, is explained on a Gestalt basis.



We can not rid ourselves of the diagonal lines' effect as we observe the horizontals. Hence the line at the right, being part of a larger whole, seems longer. Other theories are proposed, but this has most support.

Other illustrations hinge on contrast effects. Geza Révész, a Hungarian psychologist teaching in Holland, noted a striking one. Which figure is larger?



They are alike. The contrast between the long slow bottom curve of the upper figure and the smaller top curve of the lower figure creates the illusion.

How We Perceive in Three Dimensions

The brilliant artist, inventor, and scientist, LEONARDO DA VINCI, listed devices used by painters to show how far away objects are—called depth or distance. Among them were shadows, shading effects, and two kinds of perspective. Linear perspective occurs, he said, where lines converge to a point in the distance. Aerial perspective occurs where distant objects appear more hazy and blurred than near ones.

These factors now are called “psychological,” in contrast to physiological factors or actual changes within the eye.

Leonardo discovered another interesting thing about perceiving depth. In effect it was this. He held a small object about six inches in front of his nose. He shut one eye and with the other looked at a picture on the wall beyond. Part of the picture was cut off from his vision by the object. He then looked at the picture with both eyes. He saw all of it. No part was cut off. In other words, using two eyes he actually *saw behind* an interposed object. Since each eye has a different line of vision, what is cut off from one eye is seen by the other. This revealed the importance of binocular vision.

RENÉ DESCARTES suggested that changes within the eye itself help us gauge the distance of objects. Also the curvature of the eye's lens changes when we shift our gaze from far to near or vice versa. These changes, known respectively as convergence and accommodation, are physiological factors which help us to see distances.

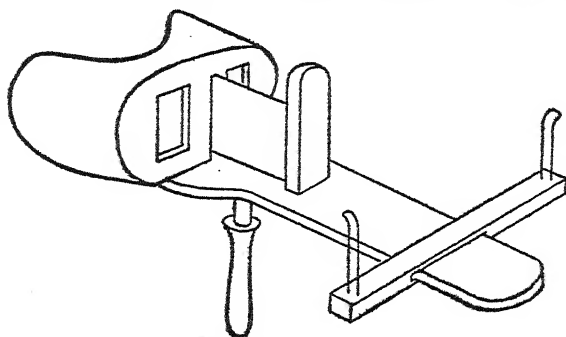
Bishop GEORGE BERKELEY elaborated Descartes' theories early in the eighteenth century. He noted three other things that occur when we perceive distance. When an object is near and the eyes converge, the sensation is more intense. When an object is very near, the image is blurred. When the curvature of the eye lens accommodates to close vision in regarding near objects, noticeable strain occurs on the eyes.

The great physicist and physiologist HERMANN VON HELMHOLTZ added other items. When two distant objects are close together, the nearer object blots out the farther one. If we move the head from side to side or walk forward or backward to examine a distant object, we get a better idea of its distance than if we remain still.

Helmholtz believed that the main helps in judging distance are convergence and accommodation, in other words physiological factors. Present-day psychologists, notably Woodworth, disagree with Helmholtz. The stereoscope reveals the importance of unsuspected psychological factors, namely the three-dimensional effects produced by two-eye vision.

The Stereoscopic Effect

Though Leonardo da Vinci and other early writers noted that our two-eye vision enables us to see behind a nearby object, they overlooked the fact that each eye receives a different image of it. To a British physicist, CHARLES WHETSTONE, goes credit for first realizing the importance of this difference. Whetstone invented in 1838 an apparatus he called a "stereoscope." By using mirrors, he presented slightly different pictures to the right and



left eyes. The pictures could be adjusted to give a vivid impression of depth. When identical instead of differing pictures were used, no depth effect resulted.

An improved stereoscope soon was devised by SIR DAVID BREWSTER. The brilliant American poet and doctor, OLIVER WENDELL HOLMES, perfected the well-known hand stereoscope, pictured on page 237.

As photography developed, providing pictures, the stereoscope became a popular parlor pastime. In the stereoscope's rack is placed a card containing two photographs, side by side, taken from points as far apart as the eyes ($2\frac{1}{2}$ to 3 inches). The stereoscope lens fuses the left-eye picture and right-eye picture, resulting in a striking effect of depth or distance. It proved the extreme importance of two-eye vision in perceiving distance. That the stereoscope does not give as perfect a fused image as the eyes themselves suggests that other factors play a part in our ability to see objects in three dimensions.

Summarizing psychological studies we see that perceiving has several characteristic features. It is selective; we always react to but one aspect of the total environment. It involves meaning in terms of past experience and of present mental set. It consists, not of several disconnected items, but of experiences which are integrated wholes.

CHAPTER XVII

Thinking

BINET KÜLPE MORGAN HOBHOUSE THORNDIKE
YERKES KÖHLER TOLMAN HUNTER MAIER
DEWEY RUGER WOODWORTH HOLLINGWORTH
WATSON CLAPARÈDE PIAGET BURT HULL



Does thinking go on in images? What is the "stuff" of thinking? Do animals think? What is meant by "insight"? What helps and what hinders human thought? How is reasoning related to thinking? What is the difference between deductive and inductive reasoning?

PHILOSOPHERS and the earliest psychologists assumed that thinking, like remembering, occurs by means of association of ideas and images. Late nineteenth century psychologists began to study thinking experimentally. In connection with their investigations of learning they experimented upon problem solving in animals and human beings. Most recently psychologists have turned to the study of logical reasoning and to the processes of creative thought.

The Nature of Thought Processes

ALFRED BINET, later to become famous as the originator of intelligence tests, pioneered in the investigation of thinking and

reasoning. Using his two daughters as subjects, he asked them to describe their thought processes. He found very often that no images or other sensory components were present. Binet therefore concluded, contrary to tradition and to earlier theories of his own, that images are not essential to thinking. The materials of thinking are simply *pensées*, or thoughts incapable of further analysis.

About the same time OSWALD KÜLPE and several of his students at Würzburg began systematic study of thinking. Külpe doubted that thoughts go on in terms of sensations, images, and feelings, as had been claimed by the dean of German psychologists, Wilhelm Wundt.

The first of the Würzburg investigations was by KARL MARBE, who reported on the process of judgment. Subjects lifted two weights and judged which was heavier, then were asked to introspect. Though judgments were usually correct, the subjects often had no introspections to report; i.e., experienced no sensations or images. Marbe concluded that some kinds of experience must be present to account for the judgments; he called them, vaguely, "conscious attitudes."

A few years later KARL BÜHLER studied thought processes in more complex problems such as interpreting paradoxes and fables. He too concluded that thinking can occur without images and sensations. Almost simultaneously in America, ROBERT S. WOODWORTH published his findings on "imageless thought." Introspection often revealed images and sensations, but these seemed unimportant to the content or meaning of a thought. Woodworth emphasized consciousness of relationships as the core of thinking processes.

These findings were roundly attacked by Edward B. Titchener, who insisted there can be nothing in consciousness except sensations, images, and feelings. Conscious attitudes, feelings of relationship, and mental sets, he said, are actually kinesthetic (muscular) sensations or images, not new kinds of thought elements at all.

By the time of World War I, the controversy over imageless thought had quieted down, but experimental work continued. Thomas V. Moore, of the Catholic University of America, for example, studied the time relations between appearance of meaning and of images in thinking. He found that meanings generally came first, therefore must be independent of images.

One of Külpe's successors, OTTO SELZ, noted the presence in thinking of a guiding principle or plan of operation. This he called an "anticipatory schema." Suppose a person is told to name the capital of each country in a list to be read. Such an instruction gives the subject a steer or anticipation which facilitates his responses. Selz's "anticipatory schema" is similar to Marbe's "conscious attitudes" and Woodworth's feelings of relationship.

The controversy over imageless thought has been decided. The verdict is against Wundt and Titchener, who insisted that thought consists only of sensations, images, and feelings. Probably most psychologists nowadays would agree with HARRY L. HOLLINGWORTH, who states that thinking goes on in terms of all kinds of cues from our previous experience.

In his *Psychology of Thought* Hollingworth says: "I think of objects and events which are not present—say of a number of people I have known. How can I do this? A simple way would be for part of each person to be at hand—say each man's hat, or perhaps his photograph, presenting his physiognomy. I may use names which have been associated with the men, speaking, writing, or looking at them. Or I may take attitudes in each case, characteristic of the way in which each person has affected me; I may experience what I call feelings, appropriate to each. Or if I have visual imagery at my command, such imagery may also be employed." Photograph, name, gesture, attitude, feeling, and image all have meaning. Any one of these "redintegrates," or calls to mind, the person or event it symbolizes. Any or all of these varied items may function in the thinking processes.

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Bodily Bases of Thinking

The behaviorist JOHN WATSON thrust aside all introspective interpretations of thinking. Thought, he said, is nothing but talking to ourselves. Most of it occurs as subvocal speech, that is as almost imperceptible movements of muscles in the tongue, throat, and larynx. Evidence for this theory, according to Watson, is found in the young child's tendency to think out loud, a process which is discouraged by social pressure, so the child learns to think, as it were, behind closed lips. Watson believed that thinking might go on in terms of nearly any muscle action. He cited deaf and dumb individuals who think, just as they talk, in hand movements. Some have even been observed to use finger language in their dreams.

Psychologists in general do not accept Watson's theory. Experimental work has failed to reveal any correlation between thinking and movement of vocal muscles. Other objections have been advanced. Woodworth, for example, points out that words sometimes cannot be found to express a meaning which is very clearly in mind. Or again, a well-known poem can be recited while one thinks of something entirely different. Finally, says Woodworth, thinking involves something new, the seeing of relationships; it is hard to account for this solely on the basis of muscular activity.

Nowadays psychologists speak of two theories of thinking—the "central theory" and "motor theory." According to the *central* theory, thinking and reasoning depend upon brain processes alone. Adherents of the newer *motor* theory, like Watson, maintain that thinking is a function, very largely at least, of muscular responses and of neural activity in outlying portions of the nervous system. Those supporting this theory have shown that muscular activity often accompanies thinking, but thus far they have not proved that it is essential to or identical with the thinking process itself.

Brain Waves

The study of *brain waves*, or "encephalography," may at some future time give a picture of thinking in terms of electrical activity. In 1929 Hans Berger, German neurologist, reported finding "brain waves" in human beings, when two electrodes were placed on the surface of the skull. The clearest of these, called alpha waves, have about ten oscillations per second. Alpha waves are most noticeable when a subject's eyes are closed. When he pays attention, reads, or tries to solve a problem, alpha waves diminish markedly while other types of waves appear.

Research on brain waves has barely begun, and the findings are often hard to interpret. It is known, however, that alpha rhythms arise from the cerebral cortex, and that they increase with mental age—at least during the first few years of life. They also have discernible patterns during sleep, after administration of drugs and in certain abnormal mental states such as epilepsy and brain tumor. So far it has proved impossible to detect characteristic brain wave patterns corresponding to the various kinds of normal mental activity, but the lead seems a promising one and research continues.

Animal Intelligence

In accordance with his ideas on evolution Charles Darwin maintained that continuity exists between lower animals and the highest humans. Both have similar senses, instincts, emotions, and mental processes. Human beings are of course superior, but, says Darwin, animals possess in lesser degree the same traits as man. To prove his point he cited many anecdotes illustrating high animal intelligence. An apostle of Darwin, George J. Romanes, presented still more stories of the same sort. In his book, *Animal Intelligence*, Romanes says that fish display emotions of anger, pugnacity, fear, and jealousy; social, sexual, and parental feelings, and play and curiosity. He finds in birds signs

of affection, sympathy, pride, vindictiveness, and aesthetic emotions. Sagacity, slyness, and keen reasoning power are credited to dogs. Cats and monkeys, also highly intelligent, "delight in torturing for torture's sake." Many of Romanes' anecdotes, cited to back up his interpretations, are from pet lovers. A short illustration is the following:

"One day the cat and the parrot had a quarrel. I think the cat had upset Polly's food, or something of that kind; however they seemed all right again. An hour or so after, Polly was standing on the edge of the table; she called out in a tone of extreme affection, 'Puss, puss, come then—come then, pussy.' Pussy went and looked up innocently enough. Polly with her beak seized a basin of milk standing by, and tipped the basin and all its contents over the cat; then chuckled diabolically, of course broke the basin, and half drowned the cat."

As a corrective for such unverified and unscientific anecdotes, an English psychologist named LLOYD MORGAN insisted that no behavior should be interpreted as the product of higher mental faculties if it could result from simpler processes. This principle came to be known as "Morgan's Canon." When applied to the anecdotes of Darwin, Romanes, and others it showed that many human characteristics had been improperly read into animal behavior.

Animals can, however, learn to solve problems, as Morgan showed. He noted that his dog learned, after an hour or two, to pick up a knobbed stick near the knob end. The dog, said Morgan, did not reason or perceive relationships. "The process throughout was one of trial and error; gradually he found the most comfortable way of carrying the stick, and adopted it." Placed in new circumstances, an animal chances, through trial and error, to hit upon a solution.

The work of EDWARD L. THORNDIKE came shortly after that of Morgan. Thorndike studied the behavior of animals seeking escape from a puzzle box to obtain food outside. Escape could

be accomplished in such ways as pulling a string or turning a catch on the door. Thorndike found much clawing, biting, mew-ing, and other signs of trial and error behavior, in the course of which "accidental success" typically occurs. With successive trials the animal gradually focuses its activity in the area of the string or catch until the trick is learned. Like Morgan, Thorndike believed that reasoning and the seeing of relationships do not characterize problem solving in animals.

But belief in the almost superhuman abilities of animals persisted. The tallest tales concerned "Clever Hans" and the Horses of Elberfeld. Hans, a stallion, was able to spell out names, count objects in the room, and solve problems in arithmetic. The Elberfeld horses could add and subtract, tapping out answers with their feet. One of the horses, Muhamed, learned to do problems of square root after only one lesson, according to his trainer!

Psychologists studied the performance of these amazing animals. EDOUARD CLAPARÈDE noticed that the horses could not solve problems of which he himself did not know the answer. Others found the animals curiously at a loss when their trainer was out of the room. The psychologists concluded that the horses had learned to react to slight nods and other cues furnished—often quite unconsciously—by people present in the room. The animals' *perception* was developed to an incredible degree, but not their linguistic and mathematical ability!

Insight

An English psychologist, LEONARD T. HOBHOUSE, disagreed with Morgan and Thorndike. He believed animals, like human beings, can perceive relations, though in lesser degree. Hobhouse tested his theory on otters, apes, elephants, dogs, and cats. Animals can get food, he found, by pulling a string attached to it, by reaching it with a stick, by removing an obstacle, by pushing food out of a tube with a rod. For Hobhouse the secret of prob-

lem solving was seeing objects in relation to each other; he proved animals can do this.

ROBERT M. YERKES discovered that a young orangutan could get the idea of stacking boxes and standing on them to reach food, after being shown how. He noted several steps which apes take in problem solving: they inspect the problem, attend to it, try out various responses, and sometimes solve it suddenly. After getting the solution apes can repeat it and transfer it to similar problems.

As we have already seen, WOLFGANG KÖHLER, the Gestalt psychologist, introduced the term "insight" to describe solving problems by grasping relations, especially if the solution is seen suddenly. Köhler found many examples of insight in apes. They got the point of piling up boxes to reach fruit hung from the ceiling. They knocked down fruit with sticks or small branches. With a small stick they reached for a large one to rake in food outside the cage. Occasionally they could fit a small stick into a hole in the end of a larger one to make a long reaching tool.

Köhler contrasted insight with trial and error. Maze problems, or Thorndike's puzzle boxes, solved by trial and error, he said, do not indicate animal problem-solving ability because they give no chance to see relations. They are solved by chance; a better problem is one where the whole situation can be surveyed, and the subject can see its relationships.

Köhler proved that apes have insight. Two University of California experimenters, EDWARD C. TOLMAN and CHARLES H. HONZIK, wondered about insight in lower animals like rats. They built an "elevated maze," without side walls, so the rat could see the whole maze as he ran it. Of two possible paths to the goal, one short and one long, the rats chose the short path 90% of the time. When a barrier was put in that could be passed only by taking the longer route, all but one of the rats immediately chose the longer path. By observing the whole maze problem they showed immediate insight.

An ingenious test of animal thinking was made by WALTER S. HUNTER, formerly at Clark, now at Brown University. He devised a "temporal maze," in which an animal had to make, on successive trials, different responses to the same situation. Rats learned to turn right on the first trial, left on the second, right on the third, and so on. They did not learn to go right on the first two trials, and left on the next two. Some higher animals, including cats, dogs, raccoons, and monkeys, did master this. Children and adults learn it easily, of course. Generally they verbalize "twice to the right, then twice to the left." Animals successful in this kind of problem must have some ability to symbolize or to count; both are important in thinking at the human level.

NORMAN R. F. MAIER believes that animals which can combine in one act two or more reactions learned separately before, can be said to reason. He taught rats to get food on a low table. He taught them also to run a maze. Then he put a barrier around the food, but made it possible to reach the food by a roundabout course via the maze. Some rats promptly combined the two kinds of experience and got the food.

Thinking in Children

Walter S. Hunter devised a "delayed reaction" apparatus to test simple thinking in animals and children. Through a door subjects see three boxes; one containing food is lighted momentarily.

Rats and dogs could not go to the correct box without remaining pointed toward it. Hunter proved that young children could be delayed and distracted a long time and still pick out the right box. Children able to talk may have said "middle one" or some similar phrase that became a cue. But even a child of 13 months, too young to talk, succeeded. Evidently some symbols or cues operated—a kind of rudimentary thinking.

JEAN PIAGET, a famous Swiss psychologist, showed that the

thinking of children under 7 or 8 years of age is self-centered, and vague about relative judgments and cause and effect. A 5-year-old child, for instance, knows that Geneva and Switzerland go together, but has no notion of the part-whole relationship. A child of 8 begins to reflect, reason, and understand logical relationships.

On the other hand, very young children's thinking shows insight. Augusta Alpert gave 2- to 4-year-old children problems similar to Köhler's in studying apes. The youngsters showed immediate insights oftener than the apes in stacking boxes to reach a toy, or raking a toy into a play pen with a stick. Sometimes the insights were incomplete, or they arrived gradually, which occurs also in adult reasoning. Much trial and error was used, of course.

Problem Solving in Human Beings

Just what goes on in a person's mind while he works at solving mechanical puzzles interested HENRY A. RUGER. Subjects were asked to take apart a variety of metal links. They used random trial and error, as animals did in the experiments of Hobhouse and Thorndike. But much of the human trial and error went on mentally; subjects thought out certain moves and their consequences without actually making the moves. Ruger found that his subjects often got the point in a flash. Such sudden solutions generally came from analyzing or locating a part of the puzzle that caused the difficulty. This analysis was helped by a carry-over from similar problems that the subject had solved. A favorable attitude toward the problem seemed to speed up its solution. Subjects did best when absorbed in the work unaware they were being watched. They excelled when willing and able to discard unsuccessful leads and to try out new ones. Ruger showed that human problem solving is not a single process. It may involve trial and error in the form of actual manipulation, mental trial and error, analyzing the problem, rapidly seeing the point, or hours later getting the solution in a flash.

Unwarranted assumptions or mental sets give subjects a good deal of trouble with thinking problems, M. E. Bulbrook and Norman R. F. Maier found. Bulbrook asked subjects to change the color pattern of a string of beads without unstringing them or breaking the thread. Few subjects thought of breaking the beads. They wrongly assumed it was forbidden.

Often subjects fail to solve problems because they can not overcome habitual responses. In Maier's experiments one solution, for instance, involved tying pliers to a cord and swinging them like a pendulum. Half the subjects failed because pliers were firmly fixed in their minds as a tool, not as a weight.

Maier also showed that the problem-solving ability of subjects can be improved by teaching them to abandon unsuccessful leads and keep their minds open for new ideas.

How do these very important new ideas or "slants" arise? The French psychologist, Edouard Claparède, suggests a theory based on "resonance." The nature of a problem, he says, calls forth "as if by a kind of internal resonance" the items in our past experience which may be useful in satisfying the present need.

Reasoning

Reasoning is thinking which follows an orderly logical sequence. In his book, How We Think, JOHN DEWEY gives a good example of reflective thinking, or reasoning. On a ferryboat he noticed a long white pole, with a ball at the tip, projecting nearly horizontally from an upper deck. He first thought it was a flag-pole, but soon doubted this because it was horizontal and had no ropes attached to it. He then tried other possibilities. Perhaps it was an ornament. But even tugboats carried such poles, so this hypothesis was rejected. Possibly it was part of a wireless, except that wireless apparatus would be placed on top of the pilot house, the highest point on the boat.

Still another hypothesis arose: the pole might be for the purpose of pointing out the direction in which the boat is moving.

This idea seemed plausible since the pole was so placed a steersman could easily see the tip from his pilot house. Such poles would also be useful on tugboats. The hypothesis was accepted since it fitted the facts and seemed more probable than any of the others.

Five distinct steps occur in reasoning, Dewey says. First, a problem, perplexity, or difficulty arises to start the process. Then comes locating and defining the difficulty—determining carefully what the problem really is. Next, a hypothetical solution is suggested. (Three occurred in Dewey's ferryboat example above.) Next comes the essence of reasoning: developing each hypothesis until one emerges that meets all requirements. Verification completes the process; observation or, as in scientific work, experimentation provides this.

Dewey says his five steps generally, though not inevitably, occur in the order given. A trained mind best grasps what each case requires in observation, and in forming, developing, and testing ideas. It also profits most from past mistakes. "What is important," says Dewey, "is that the mind should be sensitive to problems and skilled in methods of attack and solution."

Psychologists, like philosophers, distinguish between deductive and inductive reasoning.

Deductive Reasoning

Deduction proceeds from the general to the particular, according to well established rules of logic. It is well illustrated in geometry where from certain broad axioms and postulates all sorts of conclusions can be deduced about the nature of triangles, and squares, and circles. Deduction is the fundamental method of philosophy and mathematics.

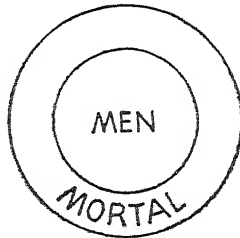
The best example of deduction is the syllogism, which dates back to the ancient Greeks. A syllogism consists of three statements—a major premise, a minor premise, and a conclusion de-

duced from the premises. If the major and minor premises are:

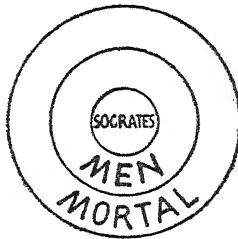
All men are mortal;
Socrates is a man;

the inevitable conclusion then is "Socrates is mortal."

Diagrams often aid deductive reasoning. An eighteenth century Swiss mathematician, L. Euler, first used them. He pictured syllogisms thus:



Since "all men are mortal," "men," shown by a small circle, fall within the larger category of "mortal." Since "Socrates is a man," "Socrates" belongs inside the "men" circle.

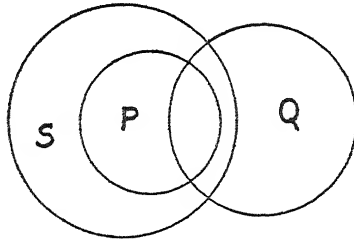


At a glance we now see Socrates must be included in the larger circle "mortal."

Euler diagrams help most with difficult syllogisms. For example, is the following reasoning correct?

All P's are S's;
Some P's are Q's;
Therefore some Q's are S's.

It may help us if we see circle P included by circle S, and circle Q intersecting both of them:



Since circle P must be entirely within circle S, and since some of circle Q must be within P, some of Q is bound to be found inside S. The conclusion, as stated, is correct.

Whether or not people tend to use diagrams when reasoning syllogistically was tested by Gustav Störring, a German psychologist. Though some subjects used diagrams, he found that often they did not. They reached conclusions directly from the premises, without visualizing.

A curious cause of *fallacies* (errors) in syllogistic reasoning was demonstrated by Robert S. Woodworth and a student. They called it the "atmosphere effect." Take the syllogism:

All x's are y's;
All x's are z's;
Therefore all y's are z's.

To most persons the conclusion sounds right. Actually it is wrong. The correct answer is "Some y's are z's." Why does the wrong one seem right? Because, says Woodworth, the word "all" in each premise builds up a general impression or atmosphere that makes "all" seem valid in the conclusion.

The atmosphere effect extends to speaking and writing, Woodworth discovered. We tend to make verbs agree with the singular or plural impression a sentence conveys, instead of with the grammatical subject. He cites examples from psychology

books, "Is trial and error blind or not?" and "A series of experiments *were* conducted . . ." Apparently we respond to general impressions, instead of to the relationship of parts.

Many reasoning problems, of course, require deduction though not presented in syllogistic form. CYRIL BURT, English psychologist, made up a test of reasoning ability for children. It consisted of items like these:

In our school a third of the school play football and a third play cricket. Are there any who play neither football nor cricket?

Yes No Can't tell

My brother writes: "I have walked over from Byford Wood today, where I had the misfortune, yesterday, to break a limb." Can you guess from this which limb he probably broke?

Right arm Left arm Right leg Left leg

Burt found the way a problem is worded greatly affects the ease of solution. About half the 8-year-olds figured out this one:

Edith is fairer than Olive, but she is darker than Lily. Who is darker, Olive or Lily?

Reworded thus, almost 75% got it:

Lily is fairer than Edith; Edith is fairer than Olive. Who is the fairest, Lily or Olive?

Complicated wording, or including irrelevant material, made reasoning hard even for older children and adults.

Inductive Reasoning

Induction means drawing a generalization from a series of particular experiences. A child, for instance, forms the general concept "animal," after experience with dogs, cats, rabbits,

squirrels, and so on. The law of gravity is a product of inductive reasoning. So are other scientific principles.

Psychologists have studied in the laboratory the type of induction called concept formation. CLARK HULL devised an experiment which called for the recognizing of certain Chinese symbols, each placed in a complex setting. When a subject was able to pick out each symbol, wherever it was found, he had formed a concept or general idea of the symbol. Hull found several interesting things. The symbols could be identified even when subjects attempted no analysis of the complex figures; this shows that concepts may be built up unconsciously. Also, the subjects formed concepts equally well whether they started with simpler figures and moved to more complex ones, or vice versa. Such a finding disagrees with the educational theory that a teacher should always start with simple ideas and progress to complex ones; it may be just as valuable to give the difficult examples first.

Thinking is not confined to human beings; problem solving and rudimentary reasoning are found in animals. Thinking does not necessarily involve images. It goes on in various symbols and vague feelings of relationship. The most orderly processes of thinking are deductive and inductive reasoning, found almost exclusively at the human level.

CHAPTER XVIII

Imagery, Imagination, and Dreams

HUME HARTLEY MILL GALTON STERN
KÜLPE JACOBSON JAENSCH FREUD ADLER
HOLLINGWORTH BLEULER GREEN SHAFFER
HELMHOLTZ RIBOT WALLAS



How do images differ from sensations? What kinds of images exist? Does everyone have imagery? What is "colored hearing"? How can eidetic imagery be tested? What are the leading theories of dream interpretation? Is it bad to day-dream? Under what conditions does creative thinking or imagination most often occur?

WE HAVE three kinds of mental images. One is the after-image, wherein we see, hear, or feel an object for a brief instant after it is removed. In vision there are positive and negative after-images. In the positive we see an object as it was just before disappearing. After a light is turned out, for example, we have a fleeting image of the bulb or lampshade. Negative after-images are an opposite or "complementary" sensation of color or brightness. If we gaze for half a minute at a spot of bluish green, then look a few inches to right or left, we see a red image of the same size and shape, which lasts for several seconds. The negative after-image of an

electric light is a black image of the bulb. After-images result from a lag in our sensory receptors.

Memory images, less vivid and accurate than after-images, are duplicates of original sensations and perceptions which may occur when we recall previous experiences.

Eidetic images are amazingly vivid, almost photographic, reproductions of objects recently seen. They are common among children but rare in adults.

Early research on imagery dealt with memory images almost exclusively.

Early Theories of Imagery

In the eighteenth and early nineteenth centuries, psychologists used the term "image" synonymously with "idea," "association," and "thought." They assumed memory and thinking involved definite imagery. But they did not test their assumptions experimentally.

DAVID HUME, a philosopher, distinguished between what he called "impression" on the one hand (later termed sensation or perception) and image or idea, on the other. Impressions, said Hume, occur in the presence of an object; images and ideas in its absence. Impressions are vivid; images are faint copies of original impressions. Today the distinction seems obvious. At that time (1739) it was a striking departure from traditional thinking.

DAVID HARTLEY, a pioneer neurologist, believed images have a bodily basis. Sensations cause nerve vibrations and arouse miniature, feeble vibrations in the brain, causing images. To show the interdependence of sensations and images, Hartley cited the positive after-image, really a persistence of sensation after the stimulus ceases. Usually images are weaker than sensations, though not always. In dreams, for instance, images may be as vivid as actual sensations. Whether weak or strong, they originate in the brain, Hartley claimed. Though even now little is known

about the neurology of images, they are still thought to result from brain processes.

JAMES MILL, British psychologist, economist, and historian, believed images are "copies" of sensations. Though the two usually can be distinguished, sometimes they are confused. Sensation must occur first, however. After seeing the sun, said Mill, shutting one's eyes does not prevent one from thinking of it. A copy or image is still present, distinct from the sensation yet more like it than anything else can be.

Galton's Study

In 1860 Gustav Theodor Fechner, a German experimental psychologist, reported that many persons lack imagery. Twenty years later FRANCIS GALTON announced astonishing results of a questionnaire on mental imagery.

Galton's survey, the first large-scale questionnaire in psychology, began as follows:

"Before addressing yourself to any of the Questions, think of some definite object—suppose it is your breakfast-table as you sat down to it this morning—and consider carefully the picture that rises before your mind's eye.

(Questions)

1. *Illumination*—Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene?

2. *Definition*—Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?

3. *Colouring*—Are the colours of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?"

Many of Galton's subjects were scientific men, chosen as the most likely to give accurate answers. Curiously enough they were

very deficient in imagery. They had no more notion of the true nature of imagery, says Galton, than a color-blind man has of the nature of color.

At the other extreme, non-scientific persons reported seeing the breakfast table as clearly as if it actually were present. Most subjects saw at least one or two items quite distinctly. Women and children had more distinct and vivid imagery than men. Galton attributed the scholars' and scientists' lack of imagery to their practice of abstract thinking carried on in symbols. "Our bookish and wordy education tends to repress this valuable gift of nature," he said. He found that many persons' imagery improved through practice.

Galton's survey did not show that persons belong to one or another sensory category according to their dominant imagery. Other investigators asserted this, however, and soon it was said that some persons were visualizers, meaning they were strong in visual imagery and weak in all other types. Other persons were "audiles," with dominant auditory imagery. Still others were "motiles," since their motor or kinesthetic imagery was keenest. A study of the French novelist Émile Zola called him the olfactory type because his thoughts and memories of persons or places occurred in terms of odors.

As usually happens with type theories, most persons did not fit neatly into one or another imagery category. Soon a "mixed type" was used to designate persons reporting imagery in several sense departments. An American psychologist, G. H. Betts, prepared an imagery questionnaire, more complete than Galton's. It called for visual images and also for images of voices, music, odors, tastes, the feel of velvet, of running, or of a headache. If imagery types exist, persons with one kind of vivid images should be weak in other kinds. Betts found the reverse true. Subjects reporting clearest imagery for one sense had also clearest imagery for other senses. Mixed imagery was the rule, and pure visual, auditory, or motor imagery very exceptional.

Objective Tests of Imagery

Galton's and Betts' studies were criticized because each subject rated the quality of his own images. The reliability of such subjective data seemed dubious. Psychologists tried to devise really objective tests of imagery.

Several methods were tried by James Rowland Angell and by Mabel R. Fernald. But none determine exactly the subject's predominant type of imagery. For example, a subject is asked to name as many colored objects as possible in a given time. Then he does the same for objects having sounds. The longer list is supposed to tell which imagery is stronger. The trouble is, a subject may get a perfectly good visual image of a noisy object, or might have an auditory image for something colored, like a child's musical toy. Or again, a subject may be asked to visualize a long word, then read off the letters in it from right to left. While this seems a fair test for visual imagery, there is no assurance that auditory or motor imagery is excluded.

The best known objective measure of imagery is the "Ausage" test, devised by the famous experimental psychologist, WILHELM STERN. Its name comes from the German word meaning "testimony." Originally the test was used to check memory accuracy. A picture is shown briefly. The subject recalls as many details as possible. Charles H. Judd found no subjects able to form an accurate visual image from which details could be read off, as from a photograph. Fernald found verbal as well as visual imagery employed; subjects named things to themselves as they looked at the picture.

Unfortunately the so-called objective imagery tests can not limit subjects rigidly to visual, auditory, motor, or other types of imagery. Despite this weakness, however, their results agree, in general, with subjective reports from the same persons. Often a combination of subjective and objective methods is used in imagery studies.

Sensations versus Images

The puzzling distinction between sensation and image, which had been noted by Hume, became the subject of some interesting experiments.

OSWALD KÜLPE tested whether sensations and images can be distinguished. Subjects placed before a screen in a darkened room were told to judge whether or not dimly colored lights appeared on the screen. Though sometimes no stimulus was shown, the subjects thought they saw it. Thus images were assumed, wrongly, to be visual sensations. Occasionally the reverse occurred: subjects thought a patch of light was merely their own image.

Later C. W. Perky, a student of Titchener, did a similar experiment. Subjects were told to visualize a banana on a screen before them. Without their knowledge she projected a faint picture of a banana on the screen. Most subjects unwittingly believed the picture was their own visual image.

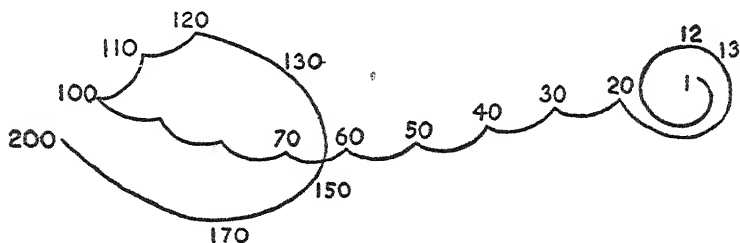
EDMUND JACOBSON, physiological psychologist, used delicate instruments to detect the electrical changes produced by muscular contractions. When subjects were asked to imagine raising a weight or pumping a tire, minute muscular contractions took place in the right arm. In fact, Jacobson found that muscular relaxation and motor imagery can not occur together. Imagery always is accompanied by tension in the muscles involved.

Electrodes placed near the eyeball showed the eye muscles active during visual imagery. Tongue and lip muscles contracted slightly when subjects imagined talking to a friend or thought about abstract ideas like "eternity." According to Jacobson's results, imagery can not occur without muscular activity.

Number-Forms and Synesthesia

Studying imagery, Francis Galton found that some persons visualize numbers in spatial patterns. Some of these patterns

formed simple lines and columns; others were quite bizarre. The following is not at all extreme:



A clocklike circle from 1 to 12 often was used. Some persons visualized in three dimensions. Dates, letters, and months of the year frequently followed an original pattern.

Other psychologists confirm Galton's results. Recently Carroll C. Pratt, of Rutgers University, found a subject who thinks of a point directly before his eyes when number 1 comes to mind. Five is higher and a little to the left. Twelve is farther away and still higher. Twenty is lower at the right. Thirty-nine is behind his right elbow. Parallel columns include 40 to 49, 50 to 59, up to 100, after which the number form tapers downward to the right of his body.

With colors, Galton's subjects noted many curious associations. One man saw his numerals this way: 1 was black; 2, yellow; 3, pale brick-red; 4, brown; 5, blackish gray; 6, reddish brown; 7, green; 8, bluish; 9, reddish brown somewhat like 6. A woman reported vowels having definite colors. A was pure white; E, red or vermillion; I, light bright yellow; O, a transparent black; U, purple; Y, a dingier color than I. Consonants were almost colorless, though M had some blackness.

A few persons see definite colors when they hear certain sounds. This is called *colored hearing*. One man reported seeing a different color for each orchestral instrument. Cases of colored odors and tastes occasionally occur. Such associations, when

stimulation of one sense organ evokes a different sensory image, are termed synesthesia.

Herbert S. Langfeld studied a case of synesthesia and found that color images associated with each note of the scale remained remarkably constant for nearly eight years. The person experienced a fusion of colors when two notes were sounded together. And the fusion followed the laws of color mixture! The associated notes and colors were as follows:

C—Red	F#—Green blue
D \flat —Purple	G—Greener blue
D—Violet	G#—Clear blue
E \flat —Soft blue	A—Cold yellow
E—Golden yellow	B \flat —Orange
F—Pink	B—Brilliant coppery

Most psychologists believe that number forms and synesthesia result from early forgotten associations that continue until they become habitual reactions.

Eidetic Imagery

In 1907 V. Urbantschitsch, German investigator, described certain persons whose imagery was as clear-cut as though the object actually were present. A few years later, ERICH R. JAENSCH, of the University of Marburg, named this "eidetic imagery." Jaensch and his Marburg associates have done most of the research in this field.

An eidetic person, after looking at a picture for half a minute or so, has a clearer, more intense and detailed memory image than ordinary persons. Often an eidetic image includes details the person failed to note in his original observation. Certain details may be larger in the image or even may appear to move. Eidetic imagery is commonest among children. Studies of youngsters from six to fourteen show it in about two-thirds of the cases.

Tests for eidetic imagery can be devised easily. Gordon W. Allport showed 30 English children a picture for just over half a minute. It was a German street scene, with men, dogs, and a

wagon, and over the door of a building the word *Gartenwirthschaft*. Projecting their image of the picture on a screen and describing it, the youngsters noted many small details when questioned about them. Some could read off the long German word, though they did not understand the language. A few even could spell it backwards!

Allport considers eidetic images a variety of memory image. Jaensch believes they belong in a category between after-images and memory images, being less realistic than the former but more so than the latter.

Dreams

Most dreams consist of visual imagery. Less than half as many are auditory. Practically all are one or the other, or a combination of the two.

Joseph Jastrow has shown that dreams depend on past sensory experiences. Testing blind persons, he found that none blinded before age 5 had visual imagery. Of those becoming blind after age 7, all had visual dream-images.

What causes our dreams? How can they be interpreted? SIGMUND FREUD's theory is best known. He believed dreams symbolize, in disguised form, our repressed desires or conflicts. This is described in Chapter XIII.

Another theory suggests that they result from physiological causes, like sleeping in odd positions, or from sensory factors like smells or sounds that disturb sleep. KNIGHT DUNLAP, of the University of California, suggests that dreams of nakedness arise from chilliness; dreams of falling possibly result from contraction of certain genito-urinary muscles that contract when we actually fall.

Lydiard H. W. Horton thinks that dreams are misinterpretations of sensory impressions. He gives these examples: a person suffering from head noises caused by an ear disorder often dreamed about thunderstorms; a student with a toothache

dreamed of boxing with a friend and getting several blows on the jaw.

HARRY L. HOLLINGWORTH describes an experiment in which a subject was stimulated several ways while asleep. When tickled on the lips and nose with a feather, he dreamed that the skin was being torn from his face. When made to breathe perfume he dreamed of entering a perfumer's shop in Cairo. When pinched on the neck he dreamed that a blister was there and his childhood doctor was treating it.

Another theory calls dreams a carry-over from our daily doings. Many persons have noted that they tend to dream about new or strenuous activities, like driving a car several hundred miles a day. F. Pierce compared the dreams of a writer, farmer, teacher, scientist, and others. He found their dreams closely tied up with their occupations and daily environment.

Related to Freud's theory is one that says dreams center about emotional states like aversion, fear, hope, and worry. Anticipation combined with an emotional state probably is the most effective background for producing dreams, according to Roy M. Dorcus, of the University of California, and G. Wilson Shaffer, of Johns Hopkins University. Often in dreams we re-live an intense emotional experience. Lowell S. Selling, a Detroit psychiatrist, found almost all the dreams of juvenile delinquents focus on their home life, about which they have strong emotional reactions.

A well-known dream theory is associated with the name of ALFRED ADLER, though actually he adopted it from earlier philosophers. It interprets dreams as turning over unsolved problems or anticipating new ones. The problems are portrayed symbolically. An imminent decision may be represented by an impending school examination, a strong opponent by an older brother, a danger by an abyss or a fall.

Gestalt psychologists hold a similar view. Any unfinished business sets up a tension and tends toward solution. One Gestaltist

found that children dream more about unfinished activities than about those they have completed.

Dream Symbolism

Often dream symbolism can be interpreted with the dreamer's help. LAURANCE F. SHAFFER gives an example:

"I seem to be standing on a street in W——, near the principal corner, with a group of unidentified people. In the group are one or two familiar young women, and I am trying to speak to them without interrupting the others. One of the young women leaves the group. I identify her now as Peg G—— and follow her running. As I am nearing the corner, a cut-down Ford comes around the turn, loaded with young people from P——. Following the Ford are two street cars, also loaded with merry-makers. Then an ox-cart, drawn by five oxen, crowds between the cars, obstructing my passage. At the risk of being run down, I push past the ox-cart and try to overtake Peg, who is well down the street by this time."

Interpreting, Shaffer goes on to say:

"This dream is silly and meaningless to the dreamer and unintelligible to the psychologist, until by questioning, the background is ascertained. A crucial point is the identity of Peg G——. The subject remembers her as a girl whom he once invited to a college dance. He and Peg quarreled throughout this social function, and thereafter regarded each other with mutual dislike. Recently the student had heard that Peg was studying painting in New York. The student has recently been escorting another girl who was also an art student. The progress of this relationship has been unsatisfactory, the student feeling that he lacks the sophistication and social graces of this girl's other companions. In his own words, he is too 'slow' for her. The meaning of the

dream is now apparent. Peg G—— symbolizes the other girl because of two very obvious relationships, her course of study and the unpleasant social relationship. The ox-cart by a very commonplace figure of speech is a symbol of slowness. This personal defect keeps the dreamer from the girl and interrupts his pursuit of pleasure. The 'slowness' gets in the way of the 'merrymaking.' "

Shaffer does not believe dream symbols always can be understood. Nor does he think Freudian and other ready-made interpretations of symbols are valid.

Hollingsworth sharply criticizes Freud's "arbitrary symbols," calling them "fantastic dogmas . . . espoused by a zealous but uncritical group of disciples." Dream images and dream symbolism, he says, follow the laws of redintegration; incoming sensory stimuli, for example, arouse images and feelings related to them in a person's waking life. However, in states of sleep or drowsiness there is a lack of mental integration. Hence unusual associations and interpretations occur. Dreams are affected also by existing mental sets and emotional states.

Hollingsworth believes dreams can be understood better by studying what takes place during drowsiness, a state between waking and sleep. He gives this illustration—a report made just after the individual recovered from his drowsiness:

"On board an ocean liner, dressing for dinner in a suit purchased abroad, sitting drowsily on the edge of the berth and thinking that the suit had turned out to be a bad investment and had been forced upon me by a tricky salesman. Planning to buy cloth next time, to be made up in America, and wondering if it would pass the Customs. Suddenly the rush of water, heard through the port-holes, becomes transformed into the husky voice of the salesman trying to sell me the suit, and repeating his previous conversation. I fall to musing in the process, wondering, while he talks, at his husky voice and why he has no more inflec-

tion. Coming to, at the sound of the dinner bell, I still hear the husky monotonous swish of the water, and realise that this is all. The incoming sensory impression had substituted itself for the memory content, in my reflection."

In such states of drowsiness, Hollingworth notes, occur images and sensory substitutions unusual in the waking life. These experiences help to explain dreams.

Most psychologists agree that no one dream theory explains everything. Interpretations often conflict. With many dreams it is hard to evaluate the part played by sensory stimuli, organic states, recent experience, and hopes, wishes, anxieties, and other emotional factors.

Woodworth makes a good suggestion. The object of interpreting a dream, he says, is not to understand that particular dream but to discover something about the dreamer's personality. If we learn something genuine about him it is worthwhile, even if the dream itself has been misinterpreted.

Daydreams

When we daydream we tend to satisfy desires unfulfilled in real life. MANDEL SHERMAN, of the University of Chicago, divides daydreams, sometimes called fantasies, into the casual and the systematic. Most of us have casual daydreams about our momentary aspirations or conflicts. Systematic daydreams recur; they involve permanent underlying motives and their frustration. If a person fails to deal with his problems realistically and gets his major satisfactions by daydreaming, personality maladjustment may be on the way.

EUGEN BLEULER calls daydreaming "autistic thinking," which implies its self-centered, illogical, and unrealistic nature. Most common is the "conquering hero" type, in which a person imagines himself performing feats of strength, achieving professional recognition and the like.

An English psychoanalyst, GEORGE HENRY GREEN, suggests four types of daydreams. The "display" fantasy involves applause for daring or brilliant performance. The "saving" fantasy pictures a rescue or other act of bravery. In the daydream of "grandeur" a person imagines himself achieving great renown. The fantasy of "homage" occurs when the dreamer gives valuable aid to someone whose love or friendship is desired.

Two other types often are noted by clinical psychologists. In the fantasy of death or destruction, a person imagines the removal of someone who stands in his way or of whom he is jealous. In the "martyr" daydream, he pictures himself injured or dead, bringing remorse to those who wrong him.

Psychologists find daydreaming common among children. Though it commonly diminishes after adolescence, adults daydream occasionally. Of 200 college students questioned by Laurence Shaffer, nearly all admitted daydreaming, at some time, about wealth, vocational success, and attracting the opposite sex. On the average they reported indulging in five or six kinds of daydreams. That half the students admitted recurrent daydreams leads Shaffer to conclude that even systematic daydreaming cannot be considered pathological.

Imagination or Creative Thinking

Sometimes we think of imagination as meaning mental imagery. It also can be applied to daydreaming, contrasted with logical, realistic thinking. Most psychologists use it to designate creative thinking, or invention. In this sense imagination means forming new combinations or patterns out of past experiences, resulting in an original product. In their book, *The Great Apes*, Robert and Ada Yerkes picture an imaginary creature that combines ape and human features. Other examples of this kind are the unicorn, centaur, mermaid, and most *Alice in Wonderland* characters.

The great German physiological psychologist, HERMANN VON

HELMHOLTZ, studied his own creative thought processes. His original ideas, he found, always followed considerable labor on the problem at hand. After a rest following the work, inspirations might come. They never appeared while his brain was fatigued or while he was drinking alcoholic liquors.

A French mathematician, Henri Poincaré, came to the same conclusion. His creative ideas did not arise while he worked at his desk. One came on an excursion, just as he stepped on a bus. Solutions of other problems flashed into his mind as he walked along the street or the seashore in a relaxed mood.

JOSEPH ROSSMAN, an American patent lawyer, studied the creative thinking of several hundred inventors. Their "hunches" too, he discovered, appeared in relaxed moments following hard work. One inventor said that his productive ideas came while he was half asleep or daydreaming; another while he was dressing, shaving, or bathing. To another they came suddenly while he listened to a concert or sat in church. The inspirations of several inventors arrived just before they dropped off to sleep or when they awoke from a good night's rest.

In 1900 a leading French psychologist, THÉODULE RIBOT, said that the inventive process springs from desire, which arouses images that the imagination arranges and combines. He observed four steps in mechanical invention: the germ, or first desire to solve a specific problem; the incubation, a long painful period of work; the flowering, or sudden solution; and completion, by which the solution is made workable—often the hardest part of the whole process.

GRAHAM WALLAS, the British psychologist and political scientist, later named four similar stages of creative thought: preparation, incubation, illumination, and verification. They were verified in Catharine Patrick's experiments on creative work. She showed a mountain scene to several dozen poets and asked them to compose a poem, talking out all their thoughts as they progressed. The preparation period included first impressions and

memories of earlier experiences. Next came incubation, best defined in this case as a recurring idea. Illumination or inspiration meant actually writing lines of the poem. Revision followed, a concluding stage corresponding roughly with the inventor's final checking or verifying.

Summarizing, we see that imagery is intensely variable. Some people have rich imagery, while others are almost totally lacking. Some children have near-photographic "eidetic" imagery. Dreams are characterized by vivid images, though their precise meaning is often difficult to interpret. Daydreaming is a wish-fulfilling rather than creative type of imagination. The crux of real creative thinking is inspiration or illumination which follows, somewhat unpredictably, a period of concentrated work on a problem.

CHAPTER XIX

Man's Social Behavior

WUNDT SPENCER TARDE LE BON ROSS
McDOUGALL MOEDE BEKHTEREV BINET MOORE
ALLPORT MURPHY DASHIELL BROWN LEWIN
SHERIF KATZ BOGARDUS THURSTONE CANTRIL
KLINEBERG DOOB HARTMANN



How does social psychology differ from individual psychology? In what ways are we affected by spectators or competitors? What is suggestion and how does it work? What kind of people are leaders? How do our attitudes arise? How can they be changed? What devices does a propagandist use? What psychological differences between sexes exist? Between races? What causes these differences?

UNTIL NOW our attention has focused on how we behave as individuals. Another aspect of our behavior is social. We are affected tremendously by the persons we see and talk to daily. They in turn are affected by us. Social psychology deals with the ways persons influence each other.

Philosophical Background

Many great thinkers, ancient and modern, have speculated on men's relations to each other and to society in general. Plato's

Republic proposes an ideal state in which each man finds a niche according to his abilities, and in which a rational social organization protects the individual against aggressions by others. For Aristotle man is a "political animal," inherently possessing possibilities for social organization and social reactions.

* Thomas Hobbes writes that man's life in the natural state—without organized society—would be "solitary, poore, nasty, brutish and short." Man's hunger, thirst, sex urge, fear, desire for honor, pleasure seeking and pain avoiding are the basis of social organization. Men formed societies to gratify their needs and avoid attack. Society grew out of man's fear and self-interest.

Several nineteenth century thinkers anticipated social psychology. In England, Jeremy Bentham originated "utilitarianism." According to this doctrine man's self-interest—his tendency to seek pleasure and avoid pain—causes much social inequality and injustice. Guided by enlightened social leadership, however, it can lead to the greatest good of the greatest number. Bentham's theories, developed by James Mill and John Stuart Mill, encouraged psychological analysis of social and economic behavior.

In 1860 a group of German anthropologists (then called "folk psychologists") founded a journal devoted to the folklore, customs, and languages of primitive peoples. They were particularly interested in the contrasting "group minds" of various races. Inspired by the folk psychologists WILHELM WUNDT began to study primitive languages, which he believed best expressed the mind of each social group. He published a five-volume work in 1900, called *Folk Psychology*. Anthropologists later criticized his conclusions on the ground that language undergoes so much borrowing and diffusion that it can not be considered an index of the mind of any group. Nevertheless, Wundt's studies made linguistics a major concern of anthropology and social psychology.

An important step toward establishing social psychology was taken by HERBERT SPENCER, an evolutionist even before Darwin published *The Origin of Species*. Spencer applied evolutionary

interpretations to social behavior and social institutions. Complex modern society can be understood only in terms of preceding social development, he says. He used the term "superorganic environment" to describe the buildings, tools, language, customs, religion, and other man-made products, in contrast to natural environment. This man-made environment, later called "culture" or the "social heritage," became a primary concern of all social scientists, including social psychologists.

Beginnings of Social Psychology

Social psychology became a separate field of study in the 1890's when laws and principles regulating man's behavior toward other men were formulated.

A Frenchman, GABRIEL TARDE, published *The Laws of Imitation*. We react to each other mainly by conscious and unconscious imitation, Tarde says. Social changes, customs, fashions, inventions, religious hysteria, and other kinds of social behavior come about by imitation. Actually, much of what Tarde included under "imitation" now is called "suggestion." He was influenced by the work of Liébeault and Bernheim on hypnosis and suggestibility.

GUSTAVE LE BON, also impressed by psychiatric studies of suggestion, wrote *The Crowd*. In it he explained crowd behavior, mobs, and mass movements on the basis of group suggestibility. The crowd is less rational, intelligent, and moral than are its component individuals. It also is more emotional, suggestible, and likely to follow leaders uncritically, just as a hysteric patient accepts a hypnotist's suggestions.

Le Bon's theory of a "group mind," existing independently of the minds of individuals composing the group, became a bone of contention in social psychology. Current theories hold that no group mind exists. They explain crowd behavior by the increased emotionality and suggestibility occurring in each individual because he is part of a mob or crowd situation.

In 1908 the first two books actually called *Social Psychology* appeared. One, written by EDWARD A. ROSS, clarified the terms "suggestion" and "imitation" and showed how they brought about contemporary social, political, and economic events. The other, by WILLIAM McDUGALL, interpreted social behavior on the basis of instincts. (McDougall's list of innate urges is described in Chapter VIII.) Social life, according to him, is native to each of us in the instincts of repulsion, pugnacity, gregariousness, and others. Social psychology can be understood through individual psychology. McDougall's views were approved and widely quoted until a reaction against instinct developed in the 1920's.

Beginnings of Experimentation

While the battle raged over instincts and over the group mind, social psychologists began to experiment instead of theorize. Before 1900 Norman Triplett, experimental psychologist, tested how children are stimulated by competition. He had them compete at winding reels that moved little flags toward a goal. Half his forty subjects worked faster when competing with others than when working alone. Ten children did worse in competition, and ten equally well in either situation. Triplett also experimented on suggestion. He did sleight-of-hand tricks for a large group of children 10 or 12 years old. When he made the motions of throwing a ball into the air, about half the children reported seeing the ball go up and disappear.

Psychologists began to realize that experiment is possible even in the complex field of social behavior. Just after World War I a wave of experimentation resulted in several significant discoveries.

Individual Behavior in Social Situations

An experiment by WALTHER MOEDE tested how well individuals work when other persons are present. One test measured

strength of hand grip. After getting a maximum for a subject working alone, Moede found it increased when the subject competed with a rival. In another test boys bore a great deal more pain when pitched against rivals to test endurance. Letters or figures on a printed page were canceled more rapidly but less accurately under competitive than under non-competitive conditions. An interesting discovery was that competition speeds up slow performers and slightly retards rapid ones.

How do spectators affect the quality of a person's work? Lee E. Travis, of the University of Iowa, compared students' accuracy in following a movable target when alone and when in the presence of spectators. Most subjects did better with an audience. Georgina S. Gates, of Barnard College, however, in a number of tests found insignificant differences between lone performance and performance before either small or large groups of spectators.

JOHN F. DASHIELL found in a similar experiment that persons tend to work faster but less accurately when spectators are present. This conclusion is confirmed in many other studies on the subject.

When co-workers instead of spectators are present, much the same thing results, according to FLOYD H. ALLPORT. Having co-workers generally steps up performance. Slow persons speed up more than fast ones, though many individual differences occur. Dashiell believes that before really conclusive results are obtained, additional questions must be answered. Is the individual competing or is he not competing with other members of the group? Is he emotionally excited or not? Is his attention distracted by others' movements? Any of the factors suggested may be quite significant.

Julius B. Maller, of Columbia University, tested the relative effectiveness of different kinds of competition. He studied school children in several competitive situations: each working for himself, working for the whole class, working for a team chosen by the pupil, working with his own sex to beat the other sex, work-

ing for an arbitrarily assigned group. Working for oneself acted as a strong incentive, but sometimes it was surpassed by working against members of the opposite sex, or working with members of a congenial group against everyone else. When asked under what conditions they would like to compete, three-fourths of the children picked self-competition. Competing as a member of a whole class or as one of an arbitrary group furnished the smallest incentive for accomplishment.

Cooperation in the form of group thinking was studied by the famous Russian psychologist, VLADIMIR BEKHTEREV. Group members discussed the probable length of a time interval, what details they saw in a picture, ethical judgments, and creative thinking. The last involved planning a monument for the Russian poet Nekrassov. Though it presented certain difficulties, group discussion in general seemed more advantageous than individual work in terms of correctness and quality of decisions.

Cooperative thinking of the jury deliberation variety was studied by Dashiell, among others. He required witnesses of certain events to testify before a jury group which then discussed the evidence. From their reports Dashiell concluded that jurors, after hearing witnesses, can tell nearly as complete a story and a slightly more accurate one than the average witness can. The whole jury, after discussion, gives a more complete and accurate account of details than any one jury member. Dashiell admits that his results are only trends. Different events or different types of witnesses and jurors might change the results considerably.

Social Interaction

How persons behave toward each other is the core of social psychology. We are interested in the nature of social behavior, in the conditions under which it occurs, and in the kinds of persons who show one or another form of it. We shall deal with suggestion, imitation, leadership, and conformity.

Suggestion

Taking a cue from psychiatric studies of hypnosis, Tarde, Le Bon, and other early social psychologists stress the importance of suggestion in social relations. But the term is not well-defined; often its meaning seems confused with "imitation." Floyd Allport clarifies the issue by defining suggestion as "unreasoned acceptance"—a kind of unthinking response to a stimulus.

Through suggestion certain activities sometimes continue though they should be changed. An experiment of ALFRED BINET showed this. He told several schoolboys to estimate the lengths of lines shown one at a time. The length of the first five increased progressively; after that, to thirty-six, they were equal. A constant gradual increase was suggested by the first five, hence the rest were overestimated. Some of the children were taken in much more than others; according to Binet they had greater "suggestibility." Older children showed less suggestibility than younger ones.

"Prestige suggestion" also was noted by Binet. Here one person's authority or reputation helps induce unreasoning responses from others. A teacher showed his pupils a line 5 cm. long and asked them to draw it from memory. He told them the next line would be a little longer. Actually it was only 4 cm. long. Ninety per cent of the children drew it longer than the first one.

HENRY T. MOORE, president of Skidmore College, tested two kinds of prestige suggestion. He asked a hundred students to make numerous linguistic, ethical, and musical judgments. Later they were told what judgments most of their group had made, and were given a chance to change their minds. Still later they were told what judgments had been made by an expert in each field and again were permitted to alter their own reactions. Both the majority and expert judgments induced much change of opinion, except in regard to musical preferences. The suggestive power of

the majority and of the experts was about equal in this experiment.

Using several tests WARNER BROWN, of the University of California, studied the difference between men and women in suggestibility. Women proved generally more suggestible than men, though not in all cases. Brown also discovered that the most suggestible persons in connection with one test were not necessarily so in connection with others. He concluded there is no one personality trait that can be called "suggestibility."

Two British psychologists, Francis Aveling and H. L. Hargreaves, tried out a battery of suggestion tests. Some resembled hypnosis: a child was told that his hand muscles were stiffening, then was asked to open his hand in order to test whether the suggestion worked. Other items resembled Binet's or included leading questions, as in court procedure. Interestingly enough some children reacted negatively to prestige; they did just the opposite of what the experimenter suggested. Some correlation between the tests was found, however. Aveling and Hargreaves concluded that suggestibility is a fairly general personality trait. Other psychologists disagree. At present the matter remains unsettled.

A new attack on the problem of suggestibility was made by MUZAFER SHERIF. He chose a laboratory situation that gave suggestion an excellent chance to operate. In a completely dark room subjects were shown a moving point of light. Their estimates of the distance it moved varied considerably because they had no standard by which to judge. As Sherif put it, they lacked a "frame of reference." Under these conditions the judgments of someone having prestige—the instructor, for example—influenced greatly the reactions of others. Sherif found in addition that the socially determined standards set up by suggestion persisted later in a re-test.

Suggestion also provided a criterion, Sherif found, in an experiment on literary preferences. He determined subjects' degree

of like or dislike for several authors such as Dickens, Poe, Scott, Conrad, and Stevenson. Later he chose several passages, all from Stevenson's writings, which he attributed to different authors. When asked to rate the passages for literary merit, the subjects judged them, in general, according to their attitudes toward the supposed authors. Thus our standards of value are shown to influence, unconsciously, behavior that we consider quite rational.

If we dislike certain prominent persons we tend to disapprove statements attributed to them, Paul R. Farnsworth, of Stanford University, and a student discovered. If we like them, we approve. College students studied by Farnsworth liked Mark Twain, Will Rogers, and Thomas A. Edison, hence tended to agree with their views. When the same views were assigned to Aimee Semple McPherson or William Randolph Hearst, greater disapproval of the views was registered.

Imitation

In a popular sense "imitation" means anything from following the leader to copying a design. In their comprehensive *Experimental Social Psychology*, GARDNER and LOIS MURPHY and THEODORE NEWCOMB distinguish three kinds of imitation. First, the conditioned response type, where one response acts as the stimulus to a similar response. An example is the child, stimulated by the sound of his own voice, who repeats the same word over and over. Another example is furnished by feeble-minded persons who mechanically repeat heard words and syllables. Second is trial-and-error imitation. After much random activity an animal learns to do what other animals have done. (Animals seldom imitate an act without first learning it through trial and error.) Third is the deliberate intentional imitation of humans.

Social psychologists now question earlier views, like Tarde's, which explained most social behavior by the operation of a process, or force, called imitation. Behavior similarities may occur for

several reasons, including pure chance. Even when imitation does take place, as Ellis Freeman points out, it does not occur blindly. We imitate only acts which have meaning for us and harmonize with our desires. A girl gets a hair-do like the reigning movie actress's, says Junius F. Brown, of the University of Kansas, not because of a force called imitation, but because she believes the new coiffure will make her more like the actress or the heroine she portrays.

An interesting experiment, on the other hand, shows how unconscious imitation can occur. Daniel Starch asked subjects to copy, in handwriting, specimens given them. One specimen was typed; three were in different kinds of script. Though told to write in their usual way, every subject imitated either the slant or width of letters in the specimen, or both. Suggestion, of course, operated to bring about the imitation in this case.

Leadership

The nature of leadership concerns social psychologists less than the characteristics of leaders. Leaders are dominant persons, yet leadership and domination are not the same thing. As P. J. W. Pigors says, leadership means guiding human beings in pursuit of a common cause. Domination means assuming superiority and using it to regulate others' activities for one's own ends.

Lewis Terman studied the characteristics of leaders among children, as rated by their companions. Leaders tended to be either very good or very bad in appearance, health, social status, school work, boldness, and fluency of speech. They stood out from others in having atypical characteristics.

Elton D. Partridge studied Boy Scout leaders selected by vote of the scouts and endorsed by the scoutmaster. These leaders were taller, heavier, better looking, more athletic, more intelligent, and more independent than the other boys. Partridge found that boys chosen as leaders one year remained leaders a year later.

Floyd H. Allport and Luther L. Bernard, among others, list

qualities possessed by leaders. Included are good appearance and physique, high intelligence, energy, initiative, persistence, and ability to deal with people. Besides having these qualities, J. F. Brown says, a successful leader must be recognized as a member of the group he is trying to lead. He must not be an outsider. At the same time his characteristics must set him above and somewhat apart from the others.

KURT LEWIN and two associates undertook a study of leadership in action. Equated clubs of 10-year-old boys were placed under three types of adult leadership: authoritarian, democratic, and *laissez-faire*. In the authoritarian group the leader dictated all policies and activities. Under democratic leadership the boys decided their own program, aided and encouraged by the leader. The *laissez-faire* leader remained completely aloof from his boys unless asked questions directly.

In general, boys under autocratic leadership were either more hostile or more apathetic than those in the other groups. Often hostility took the form of aggression against a "scapegoat" in the group—obviously an outlet for the frustration experienced under the autocratic leader. Lewin also found that boys accustomed to authoritarianism could not change easily to a freer setting or atmosphere. Democratic leadership was preferred by the great majority of the boys; as might be expected it produced the fewest examples of unfavorable social behavior.

Conformity

Only a few are leaders; most of us follow. Likewise few of us depart from the usual and conventional; mostly we conform to the institutions of our community.

Just how much we conform, even in the small ways of common situations, was studied by FLOYD ALLPORT and his students. He observed 1,000 pedestrians at a traffic light guarded by a policeman. Almost 90% obediently waited at the curb until the green light appeared. About 8% waited just off the curb. Two

per cent ventured to the middle of the intersection, then waited, while a negligible .3% struck across, defying the light altogether. Other studies dealt with employees' punctuality in arriving at work, Catholics taking part in the Holy Water ceremony, and workers' promptness in registering for employment. In each situation an overwhelming majority conformed to the usual behavior. A few departed slightly, but practically no one proved completely nonconformist.

DANIEL KATZ and RICHARD L. SCHANCK, in their book, *Social Psychology*, give five reasons why we conform, and tend to follow rather than lead. Conforming is easier; it saves time, energy, and thought not to make one's own decisions. It is more economical and efficient and avoids confusion. Nonconformity brings censure, fines, and other penalties, or at best social disapproval. Our egos are enhanced by being good conforming members of our various social groups like a university, church, or whole nation; we can take credit for group accomplishments. Finally, we are brought up to conform, do things in unison, and obey our leaders; it soon becomes a habit.

Attitudes

An attitude is more than a state of mind. It is a tendency to act. A person's attitudes determine in large measure how he will behave. Some social psychologists go so far as to define social psychology as the scientific study of attitudes.

Usually attitudes are divided into the favorable and unfavorable, or positive and negative. But we may also classify attitudes as specific and general, temporary or permanent, public or private, common or individual.

GORDON W. ALLPORT, who defines attitude as a "neuropsychic state of readiness for mental and physical activity," says attitudes are built up in several ways. They may arise as a kind of residuum from many similar experiences. They may originate in a single dramatic instance, such as a great emotional shock. Or they may

be taken over ready-made from parents, teachers, companions, and others.

A study of Communist leaders in Russia, made by Jerome Davis, who formerly taught at Yale University, finds no less than 25 influences determining revolutionary attitudes. Teachers, fellow-students and fellow-workers, books, and the family were most important. Frequent persecution also had helped implant attitudes, as had occasional shocking experiences. Three-quarters of the Communist leaders began their radical activity by the age of 21.

The genesis of children's racial attitudes was studied by the sociologist Bruno Lasker. By far the strongest influence is the unconscious adopting of prejudices from parents and others, he found. Slighting names, like "kike" or "nigger," are picked up quickly by a child, as are intolerance and actual persecution if they prevail in his social group.

Measuring Attitudes

Three techniques commonly are used to measure attitudes and opinions. (Psychologists consider an *opinion* the expression of an *attitude*; opinions may not reveal true attitudes, but the latter rarely can be studied directly.) One method is the poll, or census, recently used on a nation-wide scale by George Gallup and others studying opinion on current questions. Another is the questionnaire containing several items on a subject such as race prejudice, conservatism, or pacifism. The experimenter weighs and scores questions, arriving at a final quantitative score. Louis L. THURSTONE, of the University of Chicago, improved this technique by preparing tests scientifically so that fewer but more representative questions are used, on a scale running from strongest "like" to strongest "dislike." Hundreds of studies based on these three methods reveal interesting facts about our attitudes.

How we feel toward other races and nationalities was shown by EMORY S. BOGARDUS in a "social distance test." American sub-

jects were asked to which of the following categories they would admit members of several groups (Armenians, Canadians, Chinese, English, Germans, Italians, Jews, Negroes, Spaniards, Turks, etc.):

1. To close kinship by marriage
2. To my club, as personal friends
3. To my street as neighbors
4. To employment in my occupation in my country
5. To citizenship in my country
6. As visitors only to my country
7. Would exclude from my country

Interesting though hardly unexpected results emerged. Canadians, English, and north Europeans were favored. Antipathy appeared toward Hindus, Japanese, Negroes, and Turks. Prejudice or "social distance" was smallest where subjects considered themselves closely related to the groups in question.

Curiously enough, a subject's experience with individuals of the various races affected his attitude only slightly. Bogardus found most prejudice toward Turks, yet few subjects had known or even seen a Turk! Again this shows how we take over our attitudes ready-made; this prejudice can be explained by atrocity stories that appeared during and after World War I.

Manly H. Harper, educational psychologist, developed a test to show our degree of liberalism or conservatism. Giving it to school superintendents all over the country, Harper found southerners more conservative than average, westerners and midwesterners more liberal. Others using Harper's test have shown that professional people are more liberal than others, and that students become increasingly liberal as they continue in college, especially if they take social science courses. Conservative or radical teachers are found to influence students in line with their own attitudes.

About 1930 Daniel Katz and Floyd Allport tested many atti-

tudes of more than 4,000 students at Syracuse University. Their attitudes toward religion are clearest. Women inclined more to religion than men, and lowerclassmen believed more strongly in a personal God and in prayer than upperclassmen. But most kept the same religious belief through college that they held on entering. Orthodox students tended to change their attitude more than atheists or those with liberal religious views.

Attitude Correlates

Do particular attitudes tie up with certain other personality traits? Several attempts have been made to answer this question.

Katz and Allport compared students who worried about their loss of religious faith with those who reported finding in college a satisfying life philosophy. Almost twice as many of the former said they needed advice on personal problems. Worry about religious faith tied up with other kinds of maladjustment.

Thomas H. Howells, of the University of Colorado, compared 50 students extremely radical and 50 extremely conservative in their religious beliefs. He found that radicals could endure more pain, were less suggestible, more intelligent, and more persistent than the conservatives.

Several studies show liberalism or radicalism is correlated positively with amount of information. Surveying 3,000 college students Peter Odegard concluded that radicals know their subject matter better than conservatives. The same report is made by Goodwin B. Watson, Percival M. Symonds, and others after studying a variety of social and economic attitudes. The degree of correlation between attitude and information is often low, but differences in knowledge, where found, nearly always favor radicals or liberals. Harper found that persons making high scores in liberalism are more consistent in their attitudes than those making low scores, a result probably due to the more complete information possessed by the former group.

HADLEY CANTRIL has shown that people's beliefs and predic-

tions accord with their dominant attitudes. In 1937 he asked a varied group of persons to forecast social events, such as whether or not a depression would occur in the United States between 1943 and 1950, who would win the Spanish war, what would be the future of the CIO. They were also given a short attitude test. Cantril found that most of the subjects, including business men, lawyers, and communists, made predictions in line with their prevailing attitudes. If they favored Franco, they forecast his victory in Spain. Social scientists in the group, however, were able to predict independently of their wishes.

The same kind of standardized reactions, and disregard of individual variations within each group, were found by Hadley Cantril and a colleague when they compared student descriptions of men from four leading colleges:

Dartmouth—outdoor men, college-loyal, hard drinkers

Harvard—blasé, snobbish, intellectual

Princeton—style-setting, gentlemanly, smooth

Yale—college-loyal, athletic, typical college men

Modifying Attitudes

How attitudes change is shown in several interesting studies. Donald Young gave nearly 500 students a test on racial and national attitudes before and after they took a course in race problems. He found little or no change in their attitudes about the inborn ability of various races. On the other hand, Arthur Kornhauser noted an increase in liberalism after a year's survey course in economics. Hermann H. Remmers, of Purdue University, and an associate found the same true after a semester course in sociology.

In general, attitudes change more through real life experiences than through classroom lectures and discussions. Milton Hall compared the attitudes of employed and unemployed engineers during the early depression years. Those unemployed for a con-

siderable time showed a loss of religious faith and marked cynicism about the value of hard work and of traditional American ideals. Their political views became less orthodox, though not necessarily communist or socialist. About a fourth agreed that a revolution might be good for the country, but nearly as many felt the same about a dictator!

Louis L. Thurstone and associates studied attitude changes in hundreds of high school youngsters brought about by moving pictures. Tests were given a few days before and immediately after seeing a film. A follow-up attitude test often was given after several months. Thurstone found certain films definitely altered attitudes. *The Son of the Gods* produced a more favorable reaction toward the Chinese, and *Four Sons* toward the Germans. *All Quiet on the Western Front* increased pacifism, and *Street of Chance* brought a less favorable attitude toward gambling. *The Birth of a Nation* changed attitudes toward Negroes unfavorably. Most of the effects lasted many months—in one case almost two years. Repeated tests might have disclosed still more lasting effects.

Tredwell Smith, at Teachers College, Columbia University, showed how racial attitudes can change through first-hand experience. About fifty graduate students spent two week-ends in Harlem, New York's Negro section. There they met prominent Negro editors, doctors, social workers, and artists. They had tea with Negro college alumni and visited a hospital, churches, and cooperative apartments. Four attitude tests, given before and after, indicated that the experience brought significantly more favorable attitudes toward Negroes. The change lasted at least a year, a re-test showed.

Propaganda

Propaganda, a much misused term, is the technique of changing attitudes in a desired direction. LEONARD W. DOOB, of Yale University, describes propaganda as a systematic attempt to con-

trol people's attitudes, hence their actions, by suggestion. Propaganda often is distinguished from education. Everett Dean Martin, for many years director of the People's Institute in New York, says an educator tries to produce an open mind; a propagandist strives for a closed mind—closed, that is, to everything but his message.

Several experiments on propaganda have been performed. Norman C. Meier and a colleague, for instance, contrived to insert into their university daily several editorials about an Australian prime minister, previously unknown to the students. Half the editorials were laudatory, half derogatory. After students had read a series of "pro" or of "con" editorials, their attitudes toward the Australian changed significantly—a change that lasted through several months. Apparently propaganda can influence opinion noticeably in a short time if the matter discussed is new. If persons already have strong feelings about a question it is harder for the propagandist to change them.

GEORGE W. HARTMANN, teaching at the time at Pennsylvania State College, conducted a unique experiment comparing the relative strength of rational and emotional propaganda appeals. Running as a Socialist candidate for state office, Hartmann presented persuasive arguments to the voters in certain wards of a city, asking them to vote Socialist if they believed in the principles outlined. In several other wards his campaign material consisted of highly emotional appeals playing up the sadness of depression days, the imminence of war, duty to one's children, and the like. Using as a control other wards of the city where no Socialist appeals were presented, Hartmann found the following:

WARDS RECEIVING:	INCREASE IN SOCIALIST VOTE:
Emotional appeals	50%
Rational appeals	35%
No appeals (control group)	24%

Thus emotional appeals were shown to be considerably more effective than rational appeals as a propaganda device. The find-

ing is not exactly surprising, but Hartmann obtained quantitative results in a real situation, which no one had succeeded in doing before.

One of the early experimenters on propaganda, William W. Biddle, found that high school students and college freshmen became less susceptible to propaganda the more they understood its devices and methods.

In 1937 Clyde R. Miller of Columbia University, with several associates, founded the Institute for Propaganda Analysis. The aim of this organization was to train people to analyze, understand, and evaluate the many kinds of propaganda, and thus protect themselves against dangerous and undemocratic appeals. The Institute published reports on many current campaigns—those of radical groups, reactionary and fascist groups, business organizations, foreign governments, labor unions, and many more.

The "Seven Devices of the Propagandist," as described by the Institute, have become widely known. They are:

1. *Name calling*—applying emotion-arousing terms to one's opponents. Examples: "Communist," "Fascist," "un-American," "Traitor."
2. *Glittering generalities*—using high-sounding words for favored persons or causes. E.g., "Liberty," "Patriotism," "100% American."
3. *Transfer*—associating persons or causes with items already liked or disliked. E.g., a cartoon of one's political candidate swathed in the American flag.
4. *Testimonial*—as in advertising, using prominent names as endorsers.
5. *Plain folks*—being a man of the people, like a politician in galluses who is photographed with his feet on the porch rail.

6. *Card-stacking*—presenting distorted facts or figures; falsifying or omitting essential parts of the story.
7. *Bandwagon*—getting everybody to join the procession; “everybody’s doing it.”

The Institute also described other typical propagandist appeals. Among them are reinforcement of ideas by repetition, playing up to people’s fears, worries and frustrations, and displacement or blaming one’s troubles on a convenient scapegoat.

Shortly after Pearl Harbor the Institute suspended its work for the duration, on the ground that analysis of home and allied propaganda is unwelcome if not actually dangerous in wartime.

Culture and Sex Differences

The influence of social and cultural factors on personality has been described in Chapter XI. Researchers have also studied the effects of culture in producing differences between the sexes and between races.

The obvious physical differences between men and women are often assumed to cause psychological differences in interests, attitudes, and the like. Students of sex differences have two tasks: first, to discover in what respects the sexes really differ, and second, to explain why those differences occur.

Boys average slightly larger and heavier at birth than girls, but girls develop faster up to the age of 14, which accounts for their slight superiority in intelligence tests. Summarizing numerous studies, Catharine Cox Miles notes that boys are more curious, active, independent, self-expressing, and scientifically minded. Girls are superior in speech and language, in memory ability, in carrying out assigned tasks and probably in motor coordination.

Lewis Terman and Mrs. Miles, as already mentioned, made an intensive study of the interests and attitudes of hundreds of

American men and women. Men were found to be more interested in adventure, physical activity, mechanics, science, and business. Women were more interested in domestic, artistic, and humanitarian activities. Males were more aggressive, rough and fearless; females more timid, sympathetic, and emotionally expressive.

How does one account for these differences? Do they grow out of the contrasting physiological structures and functions of men and women?

Recent anthropological research suggests that this question should be answered "No" because universal male and female psychological characteristics do not exist. As we saw earlier, Margaret Mead noted a great contrast in the sexual roles found in three neighboring Melanesian societies. In one both men and women were aggressive and ruthless. In another both sexes were cooperative, mild, and unaggressive. In the third customary male and female roles were reversed, with the woman a dominant, impersonal managing partner and the man emotionally dependent and less responsible.

Another anthropologist, Alexander Goldenweiser, finds that few if any occupations are universally practiced by one or the other sex exclusively. In some cultures hunting is done by the women, cooking and housekeeping by the men. Among certain African tribes sewing was traditionally a male activity; missionary efforts to teach women to sew were greatly resented!

In other words, many of the non-biological activities performed by each sex are a product of custom rather than of physiology. Interests grow out of these daily activities. Additional evidence is furnished by contrasts among civilized nations. Women do heavy farm work in much of Europe but not in America; in Russia half the doctors and nearly all the dentists are women.

Most psychologists would agree with OTTO KLINEBERG when he says that sex differences in interests, linguistic and mechanical ability, memory, and information are best explained by the differing roles or social environments of boys and girls in our society.

Race Differences

Whether or not psychological differences between races exist is complicated by a misunderstanding of terms. *Race* frequently is confused with *nation* and with *language*; it is incorrect to speak of the "French race" or the "Aryan race." Anthropologists do not agree on the exact number of human races. They do agree that a race is a sizable portion of mankind having similar physical characteristics known to be transmitted by heredity. The Caucasian, Mongolian, and Negro races form the simplest division; many subdivisions of each have been suggested on the basis of skin-color, hair, shape of head, and many other anatomical characteristics.

As with sex differences, two questions arise: Do psychological differences between races exist? If so, do they result from innate or cultural factors?

The civilization and contribution of almost every race and nation has been called superior by some writer—generally one belonging to the group in question. Recently Nordic or "Aryan" superiority has been claimed vigorously by Count de Gobineau, Houston S. Chamberlain, and many officials of the Nazi party. According to Otto Klineberg, a specialist in race psychology, it is very hard to prove the superiority of any one race. Civilizations rise and fall, and borrow from each other. Criteria of true superiority are doubtful; is our advanced culture, so given to warfare, better than that of the primitive but peaceful Eskimo? Within each race is great variability; contrast the cultivated Chinese with the simple nomadic tribes of Siberia. In Europe the Nordic,

Alpine, and Mediterranean racial groups are distributed among a dozen nations and cultures.

Many experiments have tested the intelligence of different races. The I.Q.'s of whites average higher than those of Negroes or Indians; early psychologists took this as proof of white superiority. Recently questions have been raised by Klineberg, Stanley D. Porteus, Thomas R. Garth, and others. Intelligence tests, they point out, contain materials based on the culture and experience of whites; the questions are not fair to test other races. Motivation also is important; if one does not exert maximum effort and speed his score suffers. Most Indians and many Negroes are unaccustomed to competition and speed. They are also handicapped by poor schooling and lack of facility with language, both of which affect intelligence test results.

Klineberg proves that so-called race differences in intelligence decrease greatly as environments of each race become more similar. He compared I.Q.'s of New York white children and southern Negroes who had migrated to New York. The Negro children's average I.Q.'s rose in proportion to the length of time they had been in the superior northern environment. Average Negro intelligence never rose as high as white, but the Negro socioeconomic and educational background always is poorer than that of whites.

Only when many individuals from two or more racial groups have similar environments over a period of years starting with birth can we discover whether innate psychological differences between races exist. Meanwhile Klineberg suggests this interpretation of existing evidence: within any group individual differences in ability are determined largely by heredity; differences between groups, however, are to be explained by environment.

Believing that their field of psychology has now come of age, social psychologists are making efforts to apply their findings. A few years ago the Society for Psychological Study of Social Issues

was formed. This group fosters direct investigation of social problems and social conflicts. Its members have already cooperated in publishing books on the psychology of industrial conflict and of civilian morale. Along with other psychologists they are studying vital problems, military and civilian, connected with the war. An active committee, chaired by Gardner Murphy, is working hard on psychological aspects of peace and of post-war planning.

CHAPTER XX

Psychology in Everyday Living

TAYLOR GILBRETH MÜNSTERBERG HOLLINGWORTH
POFFENBERGER VERNON VITELES BINGHAM MOORE
STARCH HEALY HUSBAND WITMER GLUECK BURTT
SHAW JACOBSON JOHNSON DE SILVA



How has psychology improved working conditions? How does psychology aid the personnel specialist? What psychological applications are found in the world of business? What is a child guidance clinic and how does it function? With what is legal psychology concerned? In what other fields are psychological applications effective?

IN COUNTLESS WAYS the findings of the great psychologists affect our daily living. Some psychological discoveries result directly from a practical need. Lewis Terman, for instance, developed intelligence tests because schools and the business world were in need of some method for measuring of ability. Sigmund Freud was concerned mainly with curing neurotic patients; his psychoanalysis, which affects all clinical work profoundly, grew out of his day to day experience.

We are also influenced by abstract psychological principles, discovered by men of science whose chief concern is to unearth new knowledge about human behavior regardless of applications.

Francis Galton, inquirer into heredity and individual differences, originated statistical methods that facilitate all kinds of quantitative studies, like those in educational, personnel, and vocational psychology. Hermann von Helmholtz, intent on discovering how the eye and ear really function, paved the way for studies of illumination effects in industry and for various tests of sensory capacities used today in many civilian and military enterprises. Hermann Ebbinghaus working on memory, and Ivan Pavlov and Edward L. Thorndike on learning, were forerunners of educational psychology. Walter Cannon, the physiologist who studied visceral effects of human emotions, contributed much to understanding physical symptoms in nervous disorders and to later work on lie detection. Shepherd Franz and Karl Lashley, studying how parts of the brain function in monkeys and rats, made possible the retraining of patients with brain injuries.

These and other theoretical discoveries provide the basis on which applied psychologists devise ways to increase efficiency, to fit the right persons into jobs, to improve educational methods, or to relieve our personal maladjustments and anxieties.

Industrial Psychology

The keynote of industrial psychology is *increasing efficiency*. It began with the studies of FREDERICK W. TAYLOR, a pioneer in "scientific management." Taylor found that more efficient work methods step up production vastly. The average amount of pig iron a man could load on a car was $12\frac{1}{2}$ tons a day. When Taylor dictated how to bend, how to pick up the iron, when to move, when to rest, some men increased their quota to $47\frac{1}{2}$ tons a day, and all increased their output considerably.

FRANK and LILLIAN GILBRETH analyzed many jobs into their elemental operations. Motions made and time taken for each movement were checked to see where the efficiency could be improved. Hundreds of such "time and motion" studies have been made, and several new principles discovered. For example: both

arms should move simultaneously and in opposite symmetrical directions; continuous curved motions are better than jerky movements; foot pedals should relieve hands wherever possible; tools should be conveniently placed. Application of these principles increases production a great deal.

HUGO MÜNSTERBERG, one of the first applied psychologists, regarded the study of fatigue as very important in industrial psychology. His successors studied daily and weekly work curves in many factories. A typical daily production chart shows that output increases slightly until mid-morning, then falls off as lunch hour approaches. After lunch productivity rises again, though not as high as in the morning; near the end of the day it falls off sharply. Weekly output shows a similar rise and fall. Production on Monday is fair; Tuesday and Wednesday show the best record; then a gradual decline occurs until Saturday.

Fatigue studies show when rest periods should be introduced. Employers were slow to adopt rest periods, but ALBERT POFENBERGER notes that practically all rest periods, even when introduced in hit-or-miss fashion, increase production. Length of rest periods varies with the kind of work done. Usually a 10- or 15-minute period in the morning and afternoon is satisfactory. Surveying several British industries, HORACE M. VERNON reports an average production rise of 5% to 10% where rest periods are part of the routine. Others find almost phenomenal efficiency increases—100% or more. A rest period should be a complete change, physical and mental, from the work. Modern methods introduce rest periods when output is at its maximum, to *prevent* fatigue rather than *cure* it. They help workers' morale as well as productivity.

Closely related is the problem of optimum work day and work week. Formerly men worked 10 or 12 hours a day, 6 and sometimes 7 days a week. Employers frowned on any reduction as they did in the case of rest pauses. When convinced that shorter hours could increase total output, they yielded. A striking example was

furnished during World War I and again after Dunkerque in World War II, when British workers began, patriotically, to work 60 and 70 hours a week. Fatigue and nervousness increased so much that production actually declined. Vernon found that a reduction in hours from 66 to about 50 per week increased hourly output enormously and weekly output by 15%. For most industries the optimum work week runs from 40 to 48 hours. The average work week in the United States, though lowered steadily until the war began, is again on the increase. Rises above 48 hours may well result in lowered efficiency or in no actual production increase despite the patriotic motive.

Employees' motives and grievances are important to production. Whiting Williams, who worked as a laborer to observe industrial conditions, reported that a worker's desire for self-respect, for accomplishment, and for job security counts for more than his weekly wage. A study by REXFORD HERSEY, of the University of Pennsylvania, notes four major motives in workers: freedom in work methods, opportunity to use experience, permanence of the job, and a chance for promotion. Outstanding grievances concern monotony and standardization of work, worry about possible unemployment, and fear of being exploited. Minor grievances and some major ones often are handled successfully by conferences between grievance committees of unions and the plant personnel manager.

Industrial accidents are reduced greatly as a result of psychological studies. MORRIS VITELES, of the University of Pennsylvania, and others found some persons "accident-prone"; that is, they tend to have more than their expected share of accidents. Clinical study of accident-prone persons reveals fatigue, sickness, inexperience, worry, and emotional disturbances as the most likely causes. Hersey noted recurring emotional cycles, or ups and downs of mood, in workers. Most accidents occur during their "low" periods. Clinical treatment helps these persons. Teaching workers not to be careless, installing accident-proof equipment,

and requiring frequent inspection of factories also reduces industrial mishaps.

All aspects of a working environment are examined for possible psychological improvement. Clarence E. Ferree and Gertrude Rand, both of Johns Hopkins University, developed standards for optimal lighting in different kinds of work. In general, uniform indirect lighting of the "daylight lamp" variety is best. Experimenting with different colored lights they found least eye fatigue from unsaturated yellow light, more from orange yellow and greenish yellow, and most from bluish green.

Painting rooms and machinery in colors often brings excellent results. Pastel greens and blues relieve eye strain. Putting color on certain dangerous or movable parts of machines reduces accidents. "Color engineers" are learning which hues seem coolest induce cheerfulness, and make for greater safety.

Studies of distraction show that continuous noises, if not too loud, do not reduce efficiency. But loud intermittent noises cause fatigue and inefficiency. One kind of sound—music—reduces fatigue and may increase production by 10%. Experiments are being made constantly. One Westinghouse plant starts the day with band marches. When fatigue sets in toward the end of the morning and afternoon, popular rhythmic tunes are played. Lunch hour is livened up by concert and dance music. However, no evidence shows that music facilitates studying or creative work.

Atmosphere and ventilation affect workers' efficiency and well-being importantly. The bad effects of poor ventilation do not result, as popularly supposed, from reduced oxygen and increased carbon dioxide. They result from increased temperature and humidity and from lack of air circulation, the New York Ventilation Commission proved. If temperature and humidity are kept down and air circulates, discomfort does not occur.

A Yale scientist, Ellsworth Huntington, correlated the work of several thousand persons with weather conditions. He found that

normal changes in barometric pressure have little effect, but humidity and temperature changes are very important. Greatest physical activity occurred when temperature averaged 60 to 65 degrees. Maximum mental activity was reached when outside temperatures averaged 38 degrees; i.e., during the seasons of frosts. Moderate temperature changes from day to day are a favorable influence.

Effects of high altitudes on mental activity were studied recently by Ross McFarland, of Harvard University. At 16,000 feet or more, where barometric pressure is about half that found at sea level, reaction time, coordination, and association are impaired considerably.

Personnel Psychology

Personnel work involves hiring employees, placing them in the right positions, training them, supervising, recommending promotion, transfer, or dismissal, planning welfare programs, adjusting grievances, and conducting research.

Psychologists have studied the value of traditional employment devices: application blanks, letters of recommendation, photographs, and interviews. Much information called for on application blanks proves of little help. Morris Viteles found 18 of 25 questions on one blank useless in judging fitness for the job. Letters of recommendation are inadequate unless the employer requests answers to specific questions. The complimentary generalizations usually written by an applicant's friends cannot be relied on. HARRY L. HOLLINGWORTH proved the futility of trying to judge character from photographs, though photographs help give an impression of the applicant's appearance.

Although Hollingworth and Walter Dill Scott, formerly president of Northwestern University, find that interviewers judge applicants very differently, practically all firms regard the interview as the most important hiring device. WALTER V. BINGHAM and BRUCE V. MOORE, among others, analyzed interviewing. Ar

interview may be standardized or it may be informal and flexible. The latter is superior if the interviewer is skilled. The best interview is conducted privately, without rush, by a trained interviewer who lets applicants do most of the talking, who is free from bias, and who records his data immediately, before forgetting any items.

Personnel workers size up their applicants with many tests. Intelligence and aptitude tests are described in Chapters II and III. Many trade tests of performance or skill also are used, such as tests for compositors and typesetters, for motormen, for carpenters or machinists. Sometimes a whole battery of tests is given for a particular job. Tests of manual ability help measure proficiency in motor manipulation. Johnson O'Connor devised two tests of finger dexterity, used in selecting workers for jobs like watch manufacturing. Recently Charles A. Drake, industrial psychologist, developed a series of "standard job tests" to measure functions important in all kinds of production work. They include finger dexterity, coordination of the hands, and of hands with one foot, rhythm, and keenness of perception.

Another psychological tool often used in business and industry is the rating scale. It is a brief personality estimate made by those who know the individual best, such as a teacher, foreman, or former employer. Bingham and Hollingworth, among others, analyzed the advantages and disadvantages of rating scales. To be valuable a scale must deal with specific traits, they found. (It is hard to rate John Jones accurately on "loyalty" or "personality." He can be rated better on "punctuality," "appearance," or "originality," where more specific examples can be given.) "Halo effect," or the tendency for a rater's favorable or unfavorable general impression to affect all his specific judgments, must be avoided. Raters should not be asked to judge a person either "good" or "bad," but should be given several choices, such as "excellent," "good," "fair," "poor," and "very poor." Several persons should rate each individual; if their judgments agree

they probably are valid. With these precautions a personality sketch can be obtained that helps in hiring, assigning to certain jobs, transferring, promoting, or dismissing, though at best it is not very thorough.

Advertising and Selling

Psychology is used daily in business, notably in advertising, selling, and market research. Appeals and attention-getting devices were tested by Starch, Hollingworth, Poffenberger, and others. They found that headlines should be short and legible, and should arouse interest and curiosity. Strong black and white contrasts are effective; color is even better, though no one color proves generally superior to others. At present consumers prefer esthetic color effects—even reproductions of old masters—and photographs of the article itself or of persons in action. Comic strips in many types of advertisement are good. The upper right-hand portion of a page gets most attention. Front and back page magazine advertisements, double-page spreads, and page one of the advertising section are favorable locations.

RICHARD W. HUSBAND has shown that advertising appeals are most frequently keyed to quality, price, health, appearance, testimonials, time and energy saving, comfort, durability, or dependability. Others have shown that the appeals vary with the product and with age, sex, income, and geographical location of groups appealed to.

The Psychological Corporation, an organization of psychologists mostly engaged in business research work, finds that the choice and use of trade names often lack effect because certain rules are not followed. HERBERT MOORE, of Mount Holyoke College, lists some of the rules. A short, attractive and distinctive name associated with a want of the product or with the act of purchasing should be chosen. Salesmen should use the name whenever possible. The trade mark or trade name should be re-

produced in the advertisements just as it appears on the product itself.

Henry C. Link, of the Psychological Corporation, says that the most important qualities of successful salesmen are loyalty to company, knowledge of products, good moral habits, ability to judge people, sense of humor, social aggressiveness, good judgment, and common sense. Both Richard W. Husband and V. V. Anderson, studying successful salesmen, find their personalities dominant and extroverted.

The art of selling proves hard to define because products and customers vary so much. Psychologists agree that a salesman must be good at sizing up a prospect's personality, attitudes, and income, and act accordingly. Enthusiastic, dominant, extroverted persons can be taught the tricks of a good salesman, but reticent, introverted persons seldom make the grade.

A few psychologists help consumers' organizations which study scientifically the value of advertised products, and present their findings to subscribers who wish to buy intelligently.

Many more psychologists help advertisers survey consumer preferences. Often large firms conduct their own market research to find out what kind of products consumers really want. George Gallup and Daniel Starch, among others, make cross-sectional surveys of the buying public to study preferences and buying habits. Guesswork by manufacturers and advertisers is disappearing. Instead, they check to discover what goods actually are desired, and advertise them with scientifically tested appeals.

Clinical Psychology

Mental disease is treated by psychiatrists trained in medicine. Clinical and consulting psychologists deal with less serious behavior and personality problems, some of which eventually might develop into mental disease.

The first psychological clinic was founded by LIGHTNER WITMER in 1896 at the University of Pennsylvania. A few years later

the first public clinic for behavior problem children, the Institute for Juvenile Research, was established in Chicago and directed by WILLIAM HEALY. Soon the Mental Hygiene movement, founded by Clifford W. Beers, stimulated the growth of child guidance clinics. By 1940 more than 100 clinics, staffed by about 250 psychologists, were operating in the United States. (Carl R. Rogers, of Ohio State University, estimates that in all 1,000 psychologists are doing clinical work of various kinds.) A psychologist's chief clinical work is testing, though usually he helps the psychiatrist diagnose cases and plan treatment. Often he does actual therapy.

Behavior problems of children are classified by Luton Ackerson, of the Institute for Juvenile Research, under the categories of conduct and personality. Conduct problems, which cause social disturbance, include swearing, fighting, stealing, truancy, vagrancy, and sex offenses. Personality problems involve feelings of inferiority, jealousy, fears, worries, excessive daydreaming, or other symptoms. Besides these problems, child guidance clinics handle mentally deficient children, youngsters backward in school, and those with special deficiencies in speech, or in subjects such as reading or arithmetic; and children to be adopted or put in foster homes by court order.

For each child referred to a clinic, a complete case history is prepared. If done well, it can reveal causes of difficulties. Treatment is then prescribed. It may consist of retraining or reeducating the child, changing his environment, or both.

Direct treatment may be simply education similar to special tutoring. Or it may involve more subtle and extensive therapy akin to psychoanalysis. Probably one or both parents will be called in; usually the clinician has problem parents to deal with as well as problem children.

Environmental therapy may be mild, such as placing a shy, unsocial child in a scout troop with proper supervision, or arranging for him to go to camp or to have boxing lessons to build

up his self-confidence. A delinquent child or a difficult problem child may be sent to a specially selected foster home or referred to an institution.

A case is not closed after being treated or referred to a home. It must be followed over a long period. Often further interviews are held. Only when the problem clearly has disappeared is the case finally dropped.

Consulting psychologists follow similar procedure, but often are in private practice and work with adults rather than children. Their commonest problems center around sexual or marital maladjustments, vocational difficulties, and various personality maladjustments like excessive fears, worries, and frustrations.

Educational Psychology

Closely connected with clinical psychology is educational psychology. Much of the work of educational psychologists has been discussed in earlier chapters of the book, principally in connection with intelligence and aptitude testing, motivation, learning, memory, and personality. In addition to applying the results of their own researches, educational psychologists seek to make available to teachers the useful findings of psychologists in many related fields. Practically every discovery made by a psychologist has potential applications in the broad field of education.

Legal Psychology

Legal psychology falls into three divisions: courtroom psychology, guilt detection, and the psychology of delinquency and crime.

Guilt detection has been discussed in the chapter on Emotions.

Courtroom psychology concerns mainly the unreliability of testimony, which Hugo Münsterberg and others have demonstrated. A dramatic event is planned: a masked bandit appears before an audience, fires three shots, shouts a few words, and runs from the room. The audience is asked to testify as to the man's

height, clothing, the number of shots fired, his words, and the length of time he remained in the room. Most persons' testimony invariably is unreliable.

Why testimony is unreliable HAROLD BURTT explains in his book, *Legal Psychology*. Some persons have defective senses; their seeing or hearing may be impaired or limited, so they do not observe events correctly. Possibly their attention is not directed to important details which, as a result, escape their notice; witnesses, for instance, usually fail to note the license number of a hit-run car. A detective, trained to observe carefully, gets these details. Because memory is unreliable after a few hours, testimony should be taken immediately after the event if possible. The element of emotional shock can affect memory greatly. A witness is apt to be less accurate in recalling than in recognizing, but most witnesses are asked to recall and describe events. Suggestion plays an important role in court. Leading questions can trip almost any witness, though children and mentally defective persons are most susceptible to them.

Psychiatrists are called into court to testify on sanity. Perhaps psychologists should be called to check the general reliability of a witness giving testimony; such a report could suggest how much credit a witness's testimony should receive.

Juvenile delinquency is a severe behavior disorder that involves conflict with the law. About 200,000 youngsters appear in juvenile courts each year, 75% to 90% of them boys. Recent reports from psychologists, psychiatrists, and social workers are pessimistic, especially since the outbreak of war. A few years ago SHELDON and ELEANOR GLUECK, psychiatrists, studied 1,000 juvenile delinquents, and found that, despite treatment, 88% became repeaters. The average number of arrests per child was 3.6. Of the repeaters, 70% later were convicted for serious offenses. In the chapter on Heredity and Environment William Healy's studies are described. They reveal that a delinquent's chance for successful adjustment in a foster home depends largely on the

extent of his personality difficulties. When an otherwise normal child gets into delinquency through bad companions, his chance for reform is excellent if he is placed in a good environment. When young delinquents remain in their old environment, from half to three-quarters become repeaters, Healy finds.

The commonest offenses for boys are stealing, running away, truancy, and sex delinquency. For girls sex offenses provide by far the largest category, partly because a sexual offense is considered more serious for girls than for boys.

Social, economic, and cultural backgrounds of delinquents and criminals are discussed in the chapter on How Personality Develops. A typical pattern for development of delinquency involves slightly inferior intelligence (70 to 90 I.Q.) and bad home conditions such as rejection, quarreling between parents, neglect, or lax discipline. Absence of the father often is an important cause of delinquency. A socially disorganized community, of low economic status, with gangs, pool halls, and various types of vice, breeds misdemeanor and crime.

War conditions accentuate delinquency seriously. Parents' absence from the home, inadequate housing in defense centers, pared budgets for recreational projects, a general spirit of aggressiveness and lax wartime standards probably account for much of the increase. Girls' sex offenses multiply because normal social activities are interrupted and because, in the absence of boy friends, the prevailing idea is to give soldiers and sailors a "good time."

No one solution for delinquency exists. CLIFFORD SHAW shows that supervised community recreational activities help. New housing projects along with slum clearance play a part in preventing delinquency. A chance for jobs and for adequate vocational training is another beneficial factor. However, none of these will suffice unless poverty along with home conditions and personality problems of youth are dealt with. The prospect during wartime is not bright; it should be better afterwards.

Miscellaneous Applications

Some personal uses of psychological principles are very helpful.

Important to all of us is knowing how to relax. Geared to high-pressure living, we drain our energies without realizing it, by keeping certain muscles tense. EDMUND JACOBSON has found that tension which causes muscular contraction, even though no motion is apparent, results in general fatigue. It may cause insomnia, nervousness, indigestion, and even colitis. He recommends recognizing which muscles are tense and learning how to relax them. In time he believes we can learn to use only those muscles involved in necessary movement and to keep other muscles relaxed. This will relieve our bodies—and minds—of much unnecessary strain.

Interesting facts about how we sleep and what kind of sleep is best are shown by H. M. JOHNSON, of Tulane University. We commonly assume that sleeping "like a log" is efficient sleep and that restless tossing and turning indicates sleep of poor quality. Johnson built a special bed, balanced on pivots, which vibrated whenever its occupant moved. The vibrations were charted on a recording drum. A camera, focused on the bed, snapped photos whenever the sleeper moved. Normal sleeping positions were shown to change every 5 to 20 minutes. College men stayed motionless longest, averaging 13 minutes. Middle-aged men stayed still 9 minutes, and their wives 10.5 minutes. Children $2\frac{1}{2}$ to 4 years old shifted every 7.4 minutes. The earlier hours of sleep showed less movement than later ones. A striking difference between adults and children appeared in the time required to fall asleep. Adults normally drop off in 15 minutes; kindergarten children require 36 minutes. Johnson's subjects slept in all kinds of positions, including grotesque ones. He concludes that there is no one proper posture for sleeping; the body relieves strains in its various parts by shifting from one position to another.

In the battle against traffic accidents, psychology plays an im-

portant part. To improve driving, HARRY R. DE SILVA, of Harvard University, after long laboratory research, conducted a nation-wide series of drivers' clinics, teaching drivers how to avoid accidents. One of the commonest tests measures reaction time. How quickly can one apply a brake after seeing a danger signal? An average person's time lies between one half and three quarters of a second. Other tests measure a driver's ability to steer, his sensitivity to color and to glare, and the general quality of his hearing and vision.

Some drivers, like industrial workers, are "accident-prone." About 20% of 1,800 taxi drivers caused more than 50% of the total accidents; another 20% had no accidents. As in industry, accident-prone persons must be sifted out or treated by clinical methods.

An interesting finding of reaction time tests is that women perform as well as men. Alvah Lauer and Albert P. Weiss, both of Ohio State University, studying uniformity or consistency of driving, found that men do considerably better than women, probably because they are more experienced. Men handle apparatus better, but women are more careful in making stops. The investigators concluded that women are more conscientious but less skillful drivers.

Psychology for the Individual

Psychology is still a young science, and applied psychology is younger still. But both of them are mature enough to have affected in many ways the lives of all of us.

For example, the ideas of parents in bringing up their children are vastly different from what they were fifty years ago, due in large measure to the studies of child psychologists. The new ideas have reached and influenced all parents, though in varying degrees, through government pamphlets, through articles and books, through parent-teacher organizations, and by word of

mouth as parents meet and talk over their problems of child-rearing.

Changes in educational theories and practices of the last two generations have come about chiefly because of progress made in understanding the child—his development, abilities, motives, emotions, interests, and personality. Special classes for handicapped and mentally retarded children, and large-scale vocational guidance programs, as well as modernized curricula in teacher training colleges, are concrete instances of this increased understanding.

When one applies for a job in business or industry, he probably undergoes interviews and tests which stem from the advances made in personnel psychology during recent years. The job training he receives and the periodic ratings by his superiors, as well as the many efficiency-producing devices on the job, all testify to progress made in business and industrial psychology.

If parents have a behavior problem child, they take him to a child guidance clinic, which is the product of years of spade work by psychiatrists, clinical psychologists, and mental hygienists.

As readers and radio listeners all of us are affected by the efforts of psychological specialists in advertising and propaganda. As consumers and voters we may participate in market research or public opinion polls. These newly developed techniques are the work, to a considerable extent, of applied psychologists.

In these and in many other ways all of us are touched, directly or indirectly, consciously or unconsciously, by applied psychology.

But the applications are often piecemeal and less effective than they might be. Many a person would benefit, socially and professionally, from a greater knowledge of one or another aspect of applied psychology. Doctors understand their patients better if they are acquainted with the principles of abnormal and clinical psychology. Business men and industrialists find great value in the introduction of better personnel and supervising methods. Teachers, nurses, social workers, and parents are much more

effective in their work if they know the fundamentals of child and clinical psychology. All of us, as consumers and citizens, feel more effective if we become aware of the various techniques used by advertisers and propagandists—a phase of social psychology.

But over and above all these special advantages is the value of learning about human behavior in general, so that we can improve our understanding of ourselves and others. Through the study of psychology we discover the nature of intelligence, motivation, emotions, learning, thinking, and personality as a whole. We learn how individuals differ in all these respects. We find out how heredity and environment work together to produce human traits and behavior, getting a glimpse of the many influences which enter into the formation of personality. Only through such basic understanding of human nature can come the ability to predict, direct, and improve human behavior in directions which all of us desire.

Biographical Notes

ADLER, ALFRED (1870-1937). Viennese psychiatrist and one-time associate of Sigmund Freud. Broke away to found school of "individual psychology." Originated the concept of the "inferiority complex." Lectured and practiced in the United States during the latter years of his life. Among his books are: *The Neurotic Constitution*, *Problems of Neurosis*, *Understanding Human Nature*.

ALLPORT, FLOYD HENRY (1890-). Pioneer social psychologist, noted for his work on personality traits, attitudes, and conformity behavior. Teaches at Syracuse University. He wrote *Social Psychology* and *Institutional Behavior*.

ALLPORT, GORDON WILLARD (1897-). An outstanding authority on personality and morale. Teaches at Harvard University. His best-known book is *Personality—a Psychological Interpretation*.

ANDERSON, JOHN EDWARD (1893-). Well-known child psychologist, now director of the Institute of Child Welfare at the University of Minnesota.

ANGELL, JAMES ROWLAND (1869-). One of the founders of "functional psychology," with John Dewey, at the University of Chicago early in the century. Later Dr. Angell was President of Yale University. He is now educational director of the National Broadcasting Company.

ARISTOTLE (B.C. 384-322). The great Greek philosopher, who is also considered one of the first scientists because of his empirical viewpoint (basing knowledge on observation and experience). His interpretations of knowledge, sensation, and memory foreshadowed the association psychology of the 17th, 18th, and 19th centuries. Two of his most important works are *Concerning the Soul* and *Concerning Memory*.

BAIN, ALEXANDER (1818-1903). Probably the first writer and teacher to devote his full efforts to psychology. A close friend of John Stuart Mill, he divided his time between free-lance writing in London and teaching in Scotland. His books, *The Senses and the Intellect* and *The Emotions and the Will*, became standard British psychological texts for two generations.

BALDWIN, JAMES MARK (1861-1934). American philosopher and psychologist, who founded the psychological laboratories at Toronto and Princeton Universities. His great interest was mental development; his writings were very popular and were translated into many languages. His most lasting work was the *Dictionary of Philosophy and Psychology*.

BALLARD, PHILIP BOSWOOD (1865-). British educational psychologist, author of studies in memory and intelligence testing.

BEERS, CLIFFORD WHITTINGHAM (1876-1943). An American, internationally famous as the founder of the mental hygiene movement. He wrote *A Mind That Found Itself*, describing his unfortunate experiences while a mental patient.

BEKHTEREV, VLADIMIR MIKHAILOVITCH (1857-1927). Famous Russian experimental and social psychologist. He advocated an objective type of psychology, much like behaviorism, shortly before Watson founded his school.

BELL, SIR CHARLES (1774-1842). British physiologist and neurologist. Proved that "specific energies" or separate functions exist for the sensory and motor nerves.

BENEDICT, RUTH FULTON (1887-). Distinguished anthropologist, teaching at Columbia University. Author of *Patterns of Culture* and *Race: Science or Politics?*

BENUSSI, VITTORIS (1878-1927). Outstanding Italian psychologist, whose studies of respiratory changes during emotion paved the way for scientific methods of lie detection.

BERKELEY, GEORGE (1685-1753). Distinguished Irish philosopher, psychologist, and bishop, who contributed in his *New Theory of Vision* to the psychology of depth perception and of meaning.

BERNARD, LUTHER LEE (1881-). American sociologist and social psychologist, noted for his book *Instinct*, which exposed the absurdities of instinct theories. Teaches at Washington University in St. Louis.

BERNHEIM, HIPPOLYTE MARIE (1840-1919). French physician, associated with Liébeault in investigating hypnosis. He proved that some degree of hypnosis can be induced in almost anyone.

BERNREUTER, ROBERT G. (1901-). Author of a widely used personality questionnaire. Teaches at Pennsylvania State College.

BINET, ALFRED (1857-1911). Probably the most noted French psychologist. Originated intelligence tests; also contributed to the psychology of memory, thinking, suggestibility, and individual development. Founded the first psychological laboratory and first psychological journal in France. Author of *The Development of Intelligence in Children* and *The Psychology of Reasoning*.

BINGHAM, WALTER VAN DYKE (1880-). An outstanding authority on personnel work and aptitude testing. Formerly director of the Personnel Research Federation; now chief psychologist of the U.S. Adjutant General's Office. Author of *Aptitudes and Aptitude Testing*, and of *How to Interview* (with B. V. Moore).

BLATZ, WILLIAM EMET (1895-). Canadian child psychologist, recently psychological adviser for the Dionne quintuplets. He wrote *The Management of Young Children* (with H. Bott) and *The Five Sisters*.

BLEULER, EUGEN (1857-1939). Swiss psychiatrist, best known for his introduction of the term "schizophrenia" in place of "dementia precox." Author of *A Textbook of Psychiatry*.

BOAS, FRANZ (1858-1942). World-famous anthropologist, noted for his many studies of primitive peoples and for his forthright denunciation of fallacious theories of race. He taught at Columbia University for nearly fifty years. His best-known works are *The Mind of Primitive Man* and *Anthropology and Modern Life*.

BOGARDUS, EMORY STEPHEN (1882-). Prominent sociologist and

social psychologist, noted for his studies of attitude toward various races and nationalities. Teaches at the University of Southern California.

BOOK, WILLIAM FREDERICK (1873-1940). Pioneer in the psychology of learning, best known for his experimental study of learning to typewrite. Taught at the University of Indiana.

BORING, EDWIN GARRIGUES (1886-). One of the outstanding American experimental psychologists; director of the psychological laboratory at Harvard University. His *History of Experimental Psychology* is a standard reference work in the field.

BRAID, JAMES (1795-1861). British doctor, who studied and experimented with mesmerism. He re-christened it "hypnotism," and showed that it was essentially suggestion.

BREUER, JOSEF (1842-1925). Viennese psychiatrist, best known for his association with Sigmund Freud in the early days of psychoanalysis.

BRIDGES, KATHARINE M. BANHAM (1897-). English psychologist, wife of Prof. J. W. Bridges of Sir George Williams College, Montreal. Did important research on development of child's emotions.

BROCA, PAUL (1824-1880). French physiologist, who discovered in 1861 the "speech center" in the brain.

BROWN, JUNIUS FLAGG (1902-). Clinical and social psychologist, at the University of Kansas and the Menninger Clinic in Topeka. Author of *Psychology and the Social Order*.

BROWN, THOMAS (1778-1820). Scottish philosopher-psychologist, who contributed to the understanding of learning and memory by elaborating several laws of mental association. Author of *Lectures on the Philosophy of the Human Mind*.

BRYAN, WILLIAM LOWE (1860-). President emeritus of the University of Indiana. Author of a pioneer study in the learning of telegraphy (with N. Harter).

BÜHLER, CHARLOTTE (1893-). Viennese child psychologist, noted for studies of child's social development. Now teaching at Clark University, Worcester, Mass.

BÜHLER, KARL (1879-). Austrian experimental psychologist, best known for his studies of thought processes. Now teaching in the United States.

BURKS, BARBARA STODDARD (1902-1943). California research psychologist, an associate of Lewis Terman, who did famous studies of gifted children and of hereditary and environmental determinants of intelligence.

BURT, CYRIL LUDOWIC (1887-). Outstanding British specialist in child and educational psychology and in juvenile delinquency. Teaches at the University of London. His best-known book is *The Young Delinquent*.

BURTT, HAROLD ERNEST (1890-). Applied psychologist, teaching at Ohio State University. Author of *Legal Psychology* and *Principles of Employment Psychology*.

CAMPBELL, CHARLES MACFIE (1876-1943). Famous psychiatrist and mental hygienist. Born in Scotland, he came to America and taught many

years at Johns Hopkins University, later at Harvard Medical School. Author of *Destiny and Disease in Mental Disorders* and *Present-day Conceptions of Mental Disorders*.

CANNON, WALTER BRADFORD (1871-). One of the outstanding American physiologists, noted for research on physiological factors in emotion. Teaches at Harvard Medical School. His most important books are: *Bodily Changes in Pain, Hunger, Fear and Rage* and *The Wisdom of the Body*.

CANTRIL, HADLEY (1906-). Experimental social psychologist, teaching at Princeton University. Author of *The Psychology of Social Movements*.

CARMICHAEL, LEONARD (1898-). Leading physiological and experimental psychologist, formerly at Brown University, now president of Tufts College. Recently appointed director of the National Roster of Scientific and Specialized Personnel.

CASON, HULSEY (1893-). Experimental psychologist, for many years at the University of Wisconsin. Noted for his studies of the conditioned reflex.

CATTELL, JAMES McKEEN (1860-1944). A student of Wilhelm Wundt at Leipzig in the 1880's. Taught at University of Pennsylvania and Columbia University. Did famous studies of reaction time, mental testing, and backgrounds of American men of science. For many years edited *Science, Scientific Monthly, School and Society*. Founder and first president of the Psychological Corporation.

CHARGOT, JEAN MARTIN (1825-1893). Brilliant French neurologist, famed for his studies of hysteria and hypnosis.

CLAPARÈDE, EDOUARD (1873-1940). Distinguished Swiss educational and experimental psychologist, teaching at the University of Geneva. Author of significant studies of intelligence and thinking.

COGHILL, GEORGE ELLETT (1872-1941). Anatomist, of the Wistar Institute in Philadelphia, famous for his studies of behavioral development. Author of *Anatomy and the Problem of Behavior*.

CONKLIN, EDMUND S. (1884-1942). Specialist in adolescent and abnormal psychology. Taught at the Universities of Oregon and Indiana.

COOLEY, CHARLES HORTON (1864-1929). Eminent sociologist, interested in the effects of society upon the developing personality. Author of *Human Nature and the Social Order*.

DALLENBACH, KARL M. (1887-). Experimental and physiological psychologist, teaching at Cornell University.

DARWIN, CHARLES (1809-1882). World-famous British scientist, author of the theory of evolution, which soon revolutionized biology, psychology, and the social sciences. His views on instinct and expression of emotions were of direct importance in psychology. In addition to *Origin of Species* and *Descent of Man*, Darwin wrote *Expression of the Emotions in Man and Animals*.

DASHIELL, JOHN FREDERICK (1888-). Prominent experimental and social psychologist, teaching at the University of North Carolina.

DA VINCI, LEONARDO (1452-1519). Renowned Italian artist, inventor, and scientific investigator. His observations and experiments on perception of

depth and distance preceded by many centuries the work of experimental psychologists.

DE CANDOLLE, ALPHONSE (1806-1893). Swiss botanist, whose study of the backgrounds of scientists, contrary to the findings of Francis Galton, emphasized the importance of environment in their development.

DESCARTES, RENÉ (1596-1650). Most famous as a philosopher, Descartes was interested also in mathematics, physics, physiology, and psychology. He proposed a dualism between mind and body, with interaction occurring via the pineal gland at the base of the brain. The body he considered a machine; he noted many automatic acts later called reflexes. Man also has rational powers and suffers from "passions" or emotions. His most important psychological book is *The Passions of the Soul*.

DE SILVA, HARRY REGINALD (1898-). Applied psychologist, formerly associated with Harvard and Yale Universities. Noted for his studies of the psychology of automobile driving.

DEWEY, JOHN (1859-). The most famous living American philosopher. One of the founders of "functional psychology" early in the 20th century. Best known in psychology for his work on thinking, learning, and educational theory. Among his many books are: *How We Think*, *Democracy and Education*, *Human Nature and Conduct*, *Experience and Nature*.

DIX, DOROTHEA LYNDE (1802-1887). New England schoolteacher, whose crusades for humane treatment of the insane, feeble-minded, and criminal brought about improvement in institutions all over the world.

DODGE, RAYMOND (1871-1942). Noted experimental psychologist, of Wesleyan and Yale Universities.

DOLL, EDGAR ARNOLD (1889-). Noted for studies of mental defectives. Until recently director of research at the Vineland Training School in New Jersey.

DOLLARD, JOHN (1905-). Psychiatrically oriented sociologist, teaching at Yale University. Author of *Criteria for the Life History* and *Caste and Class in a Southern Town*.

DONDERS, F. C. (1818-1889). Dutch physiologist and oculist, one of the first scientists to study reaction time.

DOOB, LEONARD WILLIAM (1909-). Social psychologist at Yale University, best known for his book *Propaganda—Its Psychology and Technique*.

DOWNY, JUNE ETTA (1875-1932). University of Wyoming psychologist, noted for her test of "will-temperament."

DUNLAP, KNIGHT (1875-). Noted experimental psychologist and contributor to many branches of psychology. Helped overthrow instinct doctrines, studied emotional expression, devised a new technique for breaking bad habits. Taught many years at Johns Hopkins University; now at University of California. Among his best-known books are *Civilized Life* and *Habits; Their Making and Unmaking*.

EBBINGHAUS, HERMANN (1850-1909). One of the most famous German experimental psychologists. His studies of memory set the stage for most of

the later work in that field. Also pioneered in the measurement of intelligence. His most significant book bears the simple title *Memory*.

ELLIS, HAVELOCK (1859-1939). British philosopher and psychologist, famous for his studies of genius and of sex. Two of his most important books are *A Study of British Genius* and the many-volumed *Studies in the Psychology of Sex*.

ENGLISH, HORACE BIDWELL (1892-). Educational psychologist, teaching at Ohio State University. Author of notable studies in learning and memory.

FECHNER, GUSTAV THEODOR (1801-1887). German physicist and philosopher, who became interested in E. H. Weber's work on psychophysics—a study of the relation between stimuli and sensations. Fechner extended and improved upon Weber's work. His best-known book is *Elements of Psychophysics*.

FERENCZI, SANDOR (1873-1933). Hungarian psychoanalyst, whose theories differ somewhat from those of the orthodox followers of Freud.

FERREE, CLARENCE ERROL (1877-1942). Eminent physiological psychologist, teaching at Johns Hopkins University. Author of numerous researches on visual efficiency in collaboration with his wife, Gertrude Rand.

FLOURENS, PIERRE (1794-1867). Early French neurologist, and the first to show that the brain and nervous system act as a unit.

FRANK, LAWRENCE K. (1890-). Student of the psychology of personality and pioneer in the use of projective techniques for diagnosing personality. Vice-president of the Josiah Macy, Jr., Foundation in New York.

FRANZ, SHEPHERD IVORY (1874-1933). American physiological psychologist, noted for his work on localization of brain functions and reeducation of patients with cerebral injuries. Taught at the University of California at Los Angeles.

FREEMAN, FRANK NUGENT (1880-). Educational psychologist, author of significant studies of mental testing and of effects of environment on intelligence. Formerly at the University of Chicago; now dean of the school of education at the University of California. Among his books are *Mental Tests and Twins—a Study of Heredity and Environment* (with H. H. Newman and K. J. Holzinger).

FREUD, SIGMUND (1856-1939). World-famous Austrian psychiatrist, who founded psychoanalysis at the turn of the present century. He practiced and taught in Vienna until the Nazi conquest of 1938 drove him to England, where he died the following year. His many books include: *A General Introduction to Psychoanalysis*, *The Psychopathology of Everyday Life*, *The Interpretation of Dreams*, *Wit in Relation to the Unconscious*, *Beyond the Pleasure Principle*, *Totem and Taboo*, *The Future of an Illusion*, *Civilization and Its Discontents*.

GALL, FRANZ JOSEF (1758-1828). Viennese doctor and founder of phrenology, whose work, despite its scientific shortcomings, contributed indirectly to the advance of neurology.

GALTON, FRANCIS (1822-1911). Starting life as a child prodigy, Galton

dabbled in a number of scientific pursuits, including medicine, anthropology, and meteorology. Later he turned to biology and psychology, studying inheritance of physical traits and of talent, and devising new statistical methods for measuring individual differences. He also founded eugenics. Other researches include mental imagery, and the senses of hearing and of smell. His books are *Hereditary Genius* and *Inquiries into Human Faculty*.

GARRETT, HENRY EDWARD (1894-). Prominent experimental and differential psychologist, teaching at Columbia University. Author of *Great Experiments in Psychology*, *Psychological Tests, Methods and Results* (with M. R. Schneck), and *Statistics in Psychology and Education*.

GATES, ARTHUR IRVING (1890-). An outstanding educational psychologist and specialist in the psychology of reading. Professor at Teachers College, Columbia University.

GESELL, ARNOLD LUCIUS (1880-). One of the foremost American child psychologists, best known for his experimentally determined norms of child development. Director of the Yale Clinic of Child Development. He wrote: *Infancy and Human Growth*, *The First Five Years of Life* (with associates), *Infant and Child in the Culture of Today* (with associates).

GILBRETH, FRANK B. (1868-1924) and GILBRETH, LILLIAN M. (1878-). Early industrial psychologists, noted for their "time and motion studies." Joint authors of *Fatigue Study* and *Applied Motion Study*.

GODDARD, HENRY HERBERT (1866-). One of the first American psychologists to make systematic studies of mental deficiency. He translated and introduced the Binet test into this country. He coined the term "moron" for the highest grade of the feeble-minded. Goddard was director of psychological research for many years at the Vineland (N. J.) Training School; later he taught at Ohio State University. His writings include *The Kallikak Family* and *Feeble-mindedness—Its Causes and Its Consequences*.

GOODENOUGH, FLORENCE LAURA (1886-). Well-known contributor to child and genetic psychology and to mental testing. Teaches at the University of Minnesota Institute of Child Welfare. Author of *Developmental Psychology*.

GREEN, GEORGE HENRY (1881-). British educational psychologist, teaching at the University College of Wales. Author of *Psychoanalysis in the Classroom*.

GRIESINGER, WILHELM (1817-1868). German specialist in mental disease, who contributed to the development of psychiatry by his insistence upon a physical basis for all mental disorders.

GUILFORD, JOY PAUL (1897-). Experimental and differential psychologist and statistician. Formerly at the University of Nebraska, he now teaches at the University of Southern California. Author of *Psychometric Methods*.

GUTHRIE, EDWIN RAY (1886-). University of Washington psychologist, best known for his book *The Psychology of Human Conflict*.

HALL, G. STANLEY (1846-1924). Having studied under Wundt at Leipzig, Hall returned to found the first psychological laboratory in America at Johns Hopkins University in 1882. A few years later he became president of Clark

University. His research centered in child and adolescent psychology and in education. He founded the first American psychological journal, and became the first president of the American Psychological Association. His best-known books are: *Adolescence*, *Senescence*, *Morale*.

HALL, MARSHALL (1790-1847). Scottish physician, famous for physiological researches, especially on reflex movements.

HAMILTON, SIR WILLIAM (1788-1856). Brilliant Scottish philosopher and psychologist, who originated the theory of "redintegration."

HARTLEY, DAVID (1705-1757). British neurologist and pioneer in physiological psychology. He insisted upon a bodily basis—vibrations in the nerves and brain—for ideas, images, and associations. His theories were published in a book called *Observations on Man*.

HARTMANN, GEORGE WILFRIED (1904-). Social and educational psychologist, of Teachers College, Columbia University. Author of *Gestalt Psychology*.

HARTSHORNE, HUGH (1885-). Yale University psychologist, best known for his studies of character and personality. Wrote *Studies in Deceit* (with M. A. May).

HEALY, WILLIAM (1869-). Distinguished Boston psychiatrist and authority on juvenile delinquency. Author of *The Individual Delinquent* and *Reconstructing Behavior in Youth* (with associates).

HEIDBREDER, EDNA (1890-). Experimental psychologist, formerly of the University of Minnesota, now teaching at Wellesley College. Author of *Seven Psychologies*.

HELMHOLTZ, HERMANN VON (1821-1894). Probably the most brilliant of the 19th-century German physiologists. Of his many original contributions those on vision, hearing, and reaction time are the most significant for psychology. His theories of color vision and of hearing are still considered seriously. His major publications are *Physiological Optics* and *On the Sensations of Tone*.

HERBART, JOHANN FRIEDRICH (1776-1841). German philosopher, educator, and psychologist, famous for his theory of the dynamic nature of mental processes. He sought to apply psychological principles in education, and introduced a theory of the unconscious. He wrote a *Textbook of Psychology* and *Psychology as Science*, the first important books to use the word "psychology" in the title.

HERING, EWALD (1834-1918). One of the most famous German physiologists; noted particularly for his theories of color vision and of temperature sensation.

HEVNER, KATE (1898-). Devised a test of musical appreciation. Now Dean of Women at the University of Indiana.

HILDRETH, GERTRUDE HOWELL (1898-). Author of many studies in child, educational, and clinical psychology. Psychologist at the experimental Lincoln School of Teachers College, Columbia University.

HIPPOCRATES (B.C. 460-356?). Famous Greek physician, often called the father of medicine. His diagnoses of mental disease and his fourfold classification of personality types were influential until the 17th or 18th centuries.

HOBHOUSE, LEONARD TRELAWNEY (1864-). British philosopher and psychologist, famed for his early experiments on animal learning and thinking. Wrote *Mind in Evolution*.

HÖFFDING, HARALD (1843-1931). Outstanding Danish philosopher and psychologist. One of the first to react against Wundt's structural psychology; also to propose a theory of the subconscious. Except for his early *Outlines of Psychology* his writings are philosophical.

HOLLINGWORTH, HARRY LEVI (1880-). Pioneer in applied psychology and contributor to almost every psychological field. Noted for his studies in personnel, physiological, and abnormal psychology and for his systematic viewpoint emphasizing "reintegration." Teaches at Barnard College, Columbia University. His books include: *Vocational Psychology*, *Psychology of the Functional Neuroses*, *Mental Growth and Decline*, *Abnormal Psychology*.

HOLLINGWORTH, LETA STETTER (1886-1939). Best known for her work with gifted children; also contributed to intelligence testing and understanding the subnormal child. Wife of Harry L. Hollingworth, she was Professor of Education at Teachers College, Columbia University. Among her books are: *The Psychology of Subnormal Children*, *Special Talents and Defects*, *Gifted Children*.

HOLZINGER, KARL JOHN (1892-). Statistician and author of research studies in mental measurement, especially of effects of heredity and environment on intelligence. Co-author of *Twins—a Study of Heredity and Environment*.

HORNEY, KAREN (1885-). Psychoanalyst, now practicing in New York, who emphasizes cultural factors in the production of neurosis. Author of *The Neurotic Personality of Our Time* and *New Ways in Psychoanalysis*.

HULL, CLARK LEONARD (1884-). One of the foremost American authorities on learning. Also did important experimental studies of hypnosis, suggestibility, and effects of tobacco. Teaches at Yale University. His books include: *Aptitude Testing*, *Hypnosis and Suggestibility*, and *Principles of Behavior*.

HUME, DAVID (1711-1776). Famous Scottish philosopher, historian, and psychologist, who stressed the distinction between sense impressions and images. He also wrote on the laws of association. Author of *A Treatise on Human Nature* and *Inquiry Into Human Understanding*.

HUNTER, WALTER SAMUEL (1889-). Experimental psychologist, formerly at Clark, now at Brown University. One of the early behaviorists, he performed significant experiments on animal learning and reasoning.

HURLOCK, ELIZABETH BERGNER (1898-). Columbia University child psychologist, author of noted studies on the effects of praise and blame on children's learning.

HUSBAND, RICHARD WELLINGTON (1904-). Applied psychologist, formerly teaching at the University of Wisconsin and now in industrial work.

ITARD, JEAN MARC GASPARD (1775-1838). Associate of the great French psychiatrist Philippe Pinel, Itard won enduring fame by his patient efforts to educate the "Wild Boy of Aveyron."

JACKSON, HUGHLINGS (1834-1911). Noted British neurologist and psychiatrist, famous for his theory of the cause of epilepsy.

JACOBSON, EDMUND (1888-). Chicago physiologist and physiological psychologist, noted for his studies of muscular activity. Author of *Progressive Relaxation*.

JAENSCH, ERICH RUDOLF (1883-). German psychologist, of the University of Marburg, famous for his work on eidetic imagery.

JAMES, WILLIAM (1842-1910). Greatest figure in early American psychology. Educated in Europe as well as in the United States, James was trained first in anatomy and physiology before he turned to psychology and philosophy. His *Principles of Psychology* (1890) became the standard psychological text for a generation. His most original contributions concern the theory of emotions, instinct, transfer of training, "the stream of consciousness," and the unconscious. James was connected with Harvard as student and teacher for most of his life.

JANET, PIERRE (1859-). Distinguished French psychiatrist, noted for his studies of hysteria and other neuroses. Author of *Major Symptoms of Hysteria* and *Psychological Healing*.

JASTROW, JOSEPH (1863-1944). One of G. Stanley Hall's first students at Johns Hopkins University, Jastrow went to the University of Wisconsin and founded a psychological laboratory there. He was one of the first to devise and administer mental tests, and made many contributions to experimental psychology. His many books include *Fact and Fable in Psychology*, *Temperament and Character*, and *Effective Thinking*.

JENKINS, JOHN GAMEWELL (1901-). Experimental and applied psychologist, teaching at the University of Maryland.

JENNINGS, HERBERT SPENCER (1868-). Famous biologist, teaching at Johns Hopkins University. Author of *Behavior of the Lower Organisms* and *The Biological Basis of Human Nature*.

JOHNSON, HARRY MILES (1885-). Experimental and applied psychologist, teaching at Tulane University. Best known for his studies of sleep.

JONES, HAROLD ELLIS (1894-). Educational and child psychologist, noted for studies of intellectual development. Director of the Institute of Child Welfare at the University of California.

JONES, MARY COVER (1896-). Child psychologist at the University of California, famed for her studies on the conditioning of children's emotions. Wife of Harold E. Jones.

JUNG, CARL GUSTAV (1875-). Distinguished Swiss founder of the school of analytical psychology, a variety of psychoanalysis. His work includes important research on emotions. He originated the concepts of introvert and extrovert personality types. Author of *Analytical Psychology* and *Psychological Types*.

KATZ, DANIEL (1903-). Social psychologist, formerly at Syracuse and Princeton Universities, now teaching at Brooklyn College. Known for his work on attitudes and public opinion.

KEELER, LEONARDE (1903-). Probably the outstanding expert on the

detection of guilt. Improved the polygraph apparatus, which is now used in many parts of the country. Formerly associated with the crime detection laboratory of Northwestern University. Now in private practice in Chicago.

KELLOGG, WINTHROP N. (1898-). Experimental psychologist, teaching at the University of Indiana. Best known for his study *The Ape and the Child* (with L. A. Kellogg).

KITSON, HARRY DEXTER (1886-). One of the best-known specialists in vocational psychology; at Teachers College, Columbia University. Author of *The Mind of the Buyer* and *Psychology of Vocational Adjustment*.

KLINEBERG, OTTO (1899-). Social psychologist, noted for his studies of race differences. Teaches at Columbia University.

KOFFKA, KURT (1886-1941). One of the founders of Gestalt psychology. Born and educated in Berlin; taught at Smith College from 1927 until his death. His most noted book is *The Growth of the Mind*.

KÖHLER, WOLFGANG (1887-). A founder and leader of Gestalt psychology. Did his famous experiments on apes in the Canary Islands where, as a German, he was interned during World War I. Taught in Germany until recently, when he came to Swarthmore College. His best-known books are *The Mentality of Apes* and *Gestalt Psychology*.

KRAEPELIN, EMIL (1856-1926). Achieved fame for his experiments on drugs and fatigue before he turned to psychiatry. Outstanding among German psychiatrists, Kraepelin classified mental diseases so well that his list became the basis for present-day classifications.

KRAFT-EBBING, RICHARD VON (1840-1912). Viennese psychiatrist, best known for his studies of abnormal sex behavior. Author of *Textbook of Psychiatry* and *Psychopathia Sexualis*.

KRETSCHMER, ERNST (1888-). German psychiatrist, best known for his studies and theories of constitutional type in relation to personality. Wrote *Physique and Character*.

KRIES, JOHANNES VON (1853-1928). German physiologist, who proved that the retina has two kinds of end-organs, rods and cones, the latter being responsible for color vision.

KUHLMANN, FREDERICK (1876-1941). American student of intelligence and mental deficiency, and author of mental tests for young children. Taught at the University of Minnesota.

KÜLPE, OSWALD (1862-1915). German experimental psychologist, director of the Würzburg laboratory, where important experiments on thinking took place. Author of an influential early book called *Outlines of Psychology*.

LADD-FRANKLIN, CHRISTINE (1847-1930). Originator of one of the three most widely accepted theories of color vision. Taught at Columbia University.

LANDIS, CARNEY (1897-). Psychologist at Psychiatric Institute, Columbia University. Best known for his experimental studies of emotions.

LANGE, KARL GEORG (1834-1900). Danish physiologist, whose theory of emotions was amplified by William James and came to be known as the "James-Lange Theory."

LANGFELD, HERBERT SIDNEY (1879-). American experimental psychologist, trained in Germany. Has contributed to esthetics and the study of emotions. Teaches at Princeton University.

LARSON, JOHN AUGUSTUS (1892-). American police officer. The first person to apply successfully physiological methods of lie detection in criminal cases. His findings are reported in *Lying and Its Detection*.

LASHLEY, KARL SPENCER (1890-). Physiological psychologist, famed for his experiments on localization of brain functions. Taught at Minnesota and Chicago; now at Harvard University. His research is described in *Brain Mechanisms and Intelligence*.

LE BON, GUSTAVE (1841-1931). French writer, author of *The Crowd*, a book influential in establishing social psychology as a separate field of study.

LENNOX, WILLIAM GORDON (1884-). American psychiatrist, best known for his studies of epilepsy. Author of *Science and Seizures*.

LEUBA, CLARENCE JAMES (1899-). American psychologist, teaching at Antioch College, who made important studies on incentives.

LEWIN, KURT (1890-). Formerly identified with the Gestalt school in Germany, Lewin now teaches at the University of Iowa. He has made notable contributions on personality and in social psychology. Author of *Dynamic Theory of Personality*.

LIÉBEAULT, AMBROISE AUGUSTE (1823-1904). French physician and psychiatrist, who pioneered in using hypnosis to cure hysterical patients.

LOCKE, JOHN (1632-1704). Renowned British philosopher, who insisted that all knowledge is obtained through sensory experience, and that learning and memory depend upon "association of ideas." His most important work is the *Essay Concerning Human Understanding*.

LOMBROSO, CESARE (1835-1909). Italian anthropologist and criminologist. Author of *The Man of Genius and Crime, Its Causes and Remedies*.

LOUTTIT, CHAUNCEY MCKINLEY (1901-). Clinical psychologist at the University of Indiana. Author of *Clinical Psychology*.

MAIER, NORMAN RAYMOND FREDERICK (1900-). Experimental psychologist, teaching at the University of Michigan, noted for his studies of reasoning and of experimental neuroses in animals.

MARSTON, WILLIAM MOULTON (1893-). American physiological and consulting psychologist, noted for pioneer work in lie detection by means of blood pressure tests. Formerly at Harvard University. Now in private practice in New York.

MATEER, FLORENCE (1887-). Clinical and child psychologist at the Merryheart Schools in Columbus, Ohio. Author of *The Unstable Child*.

MAY, MARK A. (1891-). Director of the Institute of Human Relations at Yale University; noted for his studies of personality and character. Author of *Studies in Deceit* (with H. Hartshorne).

MCADORY, MARGARET (1890-). American psychologist, interested in esthetics; prepared a test for artistic aptitude. She has done research at Teachers College, Columbia University.

MCDUGALL, WILLIAM (1871-1938). Internationally famous figure in psychology. Born in England, he taught at Oxford before coming to Harvard and Duke Universities. He contributed to every branch of psychology from physiological to social. He stoutly opposed mechanism and behaviorism and espoused the purposive nature of behavior. His many books were influential; they include *Introduction to Social Psychology*, *The Group Mind*, *Modern Materialism and Emergent Evolution*.

MCGRAW, MYRTLE BYRAM (1899-). American child psychologist, specialist in development. Her experimental study of the twins Johnny and Jimmy secured nation-wide attention.

MEAD, GEORGE HERBERT (1863-1931). Distinguished philosopher, of the University of Chicago, who emphasized the part played by society in developing a child's selfhood or personality. Wrote *Mind, Self and Society*.

MEAD, MARGARET (1901-). American anthropologist and social psychologist, noted for her studies of primitive peoples in the South Seas. Author of *Coming of Age in Samoa*, *Growing Up in New Guinea*, *Sex and Temperament in Three Primitive Societies*.

MEIER, NORMAN CHARLES (1893-). Co-author of the Meier-Seashore Art Judgment Test. Teaches at the University of Iowa.

MENDEL, GREGOR (1822-1884). Austrian monk, whose experiments on plant breeding proved that laws exist by which inheritance of characteristics can be predicted.

MESMER, FRANZ ANTON (1733-1815). Viennese doctor, who discovered "animal magnetism," later called "mesmerism." Though scientists considered Mesmer a charlatan, his work stimulated research which led to later understanding of suggestion and hypnosis.

MEYER, ADOLF (1866-). Internationally famous psychiatrist and neurologist. Born in Switzerland; has practiced and taught in the United States for over fifty years, mainly at Johns Hopkins University.

MILES, CATHARINE COX (1890-). Best known for her work with Lewis Terman on studies of genius and of sex differences. Wife of Walter R. Miles, she teaches at Institute of Human Relations, Yale University.

MILES, WALTER RICHARD (1885-). Experimental psychologist, noted for his studies of alcohol effects, visual functions, and development of mental ability. Teaches at Yale University.

MILL, JAMES (1773-1836). British historian, economist, and psychologist, noted for his simplification of the laws of association. Author of *Analysis of the Phenomena of the Human Mind*.

MINKOWSKI, MIECZYSLAW (1884-). Swiss surgeon and embryologist, whose studies of fetuses showed that mass action precedes specific responses in fetal development.

MOEDE, WALTHER (1888-). German applied and social psychologist, one of the first experimenters in social psychology. Author of *Experimental Mass Psychology* and *Textbook of Psychotechnics*.

MOORE, BRUCE VICTOR (1891-). Applied psychologist, of Pennsylvania State College. Author of *How to Interview* (with W. V. Bingham).

MOORE, HENRY THOMAS (1886-). Social psychologist, now president of Skidmore College at Saratoga Springs, N. Y.

MORGAN, C. LLOYD (1852-1936). Versatile British scientist, noted as a geologist, zoologist and psychologist. He is considered the founder of scientific comparative psychology through his pioneer experiments on animal learning and thinking. Author of *Animal Life and Intelligence*, *Emergent Evolution*, and *Animal Mind*.

MORGAN, JOHN JACOB BROOKE (1888-). Child and clinical psychologist at Northwestern University; also known for his experimental studies of distraction. Author of *Psychology of the Unadjusted School Child* and *The Psychology of Abnormal People*.

MOSS, FRED AUGUST (1893-). Professor at George Washington University, best known for his work on aptitude testing.

MOSSO, ANGELO (1846-1910). One of the most famous Italian psychologists, known particularly for his work on fatigue.

MÜLLER, GEORG ELIAS (1850-1934). Distinguished German experimental psychologist, noted for his work in memory and psychophysics. He taught at the University of Göttingen and built up there a famous laboratory.

MÜLLER, JOHANNES (1801-1858). One of the greatest German physiologists. Besides making original contributions on the function of the nervous system, Müller wrote *The Elements of Physiology*, which achieved international fame as a textbook.

MÜNSTERBERG, HUGO (1863-1916). Born in Germany, Dr. Münsterberg, well-known experimental psychologist, spent his last twenty years at Harvard, where he promoted legal, industrial, and other applications of psychology. Author of *Psychotechnics*, *Psychology and Industrial Efficiency*, and *On the Witness Stand*.

MURPHY, GARDNER (1895-). Prominent social psychologist, now teaching at the College of the City of New York. Author of *A Historical Introduction to Modern Psychology* and *Experimental Social Psychology* (with L. B. Murphy and T. M. Newcomb).

MURPHY, LOIS BARCLAY (1902-). Psychologist at Sarah Lawrence College, noted for her studies of social behavior in young children. Wrote *Social Behavior and Child Personality* and *Experimental Social Psychology* (with G. Murphy and T. M. Newcomb).

MURRAY, HENRY ALEXANDER, JR. (1893-). Harvard University psychologist, known for his studies of personality. Author of *Explorations in Personality*.

NEWCOMB, THEODORE MEAD (1903-). Social psychologist, formerly of Bennington College and now at the University of Michigan. Author of *Experimental Social Psychology* (with G. and L. B. Murphy).

NEWMAN, HORATIO HACKETT (1875-). University of Chicago biologist and geneticist; specialist on twins. Collaborated with F. N. Freeman and

K. J. Holzinger on *Twins—a Study of Heredity and Environment*. He also wrote *Multiple Human Births*.

NIETZSCHE, FRIEDRICH WILHELM (1844–1900). Famous German philosopher, who proposed in his *Birth of Tragedy* two contrasting philosophies of life, or personality types, the Apollonian and the Dionysian.

O'ROURKE, LAWRENCE JAMES (1892–). Applied psychologist, specializing in aptitude testing and personnel work. Now Director of Research for the U.S. Civil Service Commission.

PATERSON, DONALD GILDERSLEEVE (1892–). Educational and clinical psychologist at the University of Minnesota. Best known for his scale of performance tests (with R. Pintner) and the Minnesota mechanical ability tests (with associates). He is the author of *Physique and Intellect*.

PAVLOV, IVAN PETROVICH (1849–1936). Russian physiologist, internationally famous for discovering the “conditioned reflex.” His years of subsequent research established conditioning as one of the most fundamental types of learning. Pavlov contributed also to abnormal psychology by producing “experimental neurosis” in dogs. His chief scientific findings are included in *Lectures on Conditioned Reflexes*.

PEARSON, KARL (1857–1936). British mathematician and scientist, a disciple of Francis Galton. He originated new statistical techniques, notably correlation. In his *Grammar of Science* he insists that science is defined by the methods it uses rather than by the nature of its subject matter.

PENROSE, LIONEL SHARPLES (1898–). British doctor and psychologist, specializing in the study of mental deficiency. His book *Mental Defect* is a standard reference work in the field.

PIAGET, JEAN (1896–). Famous Swiss child psychologist, teaching at the University of Geneva. Author of *The Child's Conception of the World* and *The Language and Thought of the Child*.

PILLSBURY, WALTER BOWERS (1872–). Prominent psychologist, associated with the University of Michigan for nearly 50 years. Author of *Attention* and *The History of Psychology*.

PINEL, PHILIPPE (1745–1826). French psychiatrist, famed for introducing humanitarian treatment of the mentally diseased.

PINTNER, RUDOLF (1884–1942). Authority on the measurement of intelligence. Co-author of the Pintner-Paterson Performance Tests; student of the psychology of deaf, physically handicapped, and mentally deficient persons. Taught at Ohio State University and Teachers College, Columbia University. His books include *Intelligence Testing*, *Educational Psychology*, *The Psychology of the Physically Handicapped* (with associates).

PLANT, JAMES STUART (1890–). Psychiatrist and clinical psychologist, director of the Essex County (N. J.) Juvenile Clinic. Author of *Personality and the Cultural Pattern*.

PLATO (B.C. 427–347). The famous Greek philosopher, pupil of Socrates and teacher of Aristotle. Plato's *Dialogues*, dealing with the whole range of

philosophical ideas, contain also the earliest theories of sensation, memory, and association of ideas.

POFFENBERGER, ALBERT THEODORE (1885-). Distinguished experimental and applied psychologist, teaching at Columbia University. Author of *The Psychology of Advertising* and *Applied Psychology*.

PORTEUS, STANLEY DAVID (1883-). Differential and social psychologist, teaching at the University of Hawaii.

PRESSEY, SIDNEY LEAVITT (1888-). Educational and differential psychologist, teaching at Ohio State University. Author of *Psychology and the New Education*.

PREYER, WILHELM (1842-1897). German physiologist, famous for his book, *The Mind of the Child*, the first systematic account of child development.

RAND, GERTRUDE (1886-). Johns Hopkins physiological psychologist, specializing in the study of visual phenomena, in collaboration with her husband, Clarence E. Ferree.

RANK, OTTO (1884-1939). Austrian psychoanalyst, best known for his proposal of the "birth trauma" theory of neurosis. Dr. Rank came to the United States a few years before his death. Among his books are: *The Trauma of Birth*, *Art and Artist*, *Modern Education*.

RIBOT, THÉODULE ARMAND (1839-1916). One of the foremost French psychologists, Ribot worked in both the experimental and abnormal fields. His books include *Diseases of Memory*, *Psychology of the Emotions*, and *Essay on Creative Imagination*.

ROGERS, CARL RANSOM (1902-). An outstanding clinical psychologist, teaching at Ohio State University. Author of *Clinical Treatment of the Problem Child* and *Counseling and Psychotherapy*.

RORSCHACH, HERMANN (1884-1922). Swiss psychiatrist, who originated the widely used inkblot test of personality which bears his name.

ROSANOFF, AARON JOSHUA (1878-1943). Noted Russian-born American psychiatrist. Teacher at the University of Southern California. Author of the widely used text, *Manual of Psychiatry*.

ROSS, EDWARD ALSWORTH (1866-). Prominent sociologist, long associated with the University of Wisconsin. Wrote the first book called *Social Psychology*.

RUGER, HENRY ALFORD (1872-). Psychologist at Teachers College, Columbia University, noted for his early study of thinking processes.

SEASHORE, CARL EMIL (1866-). Devised the widely used Seashore test of musical talent. Co-author of the Meier-Seashore Art Judgment Test. Emeritus professor of psychology and dean of the Graduate College, University of Iowa. His best-known book is *The Psychology of Musical Talent*.

SEGUIN, EDOUARD (1812-1880). Frenchman and pupil of the famous Dr. Jean Itard, Seguin devised new methods of educating and treating the feeble-minded. His form-board is still used as part of the Pintner-Paterson Performance Tests.

SELZ, OTTO (1881-). German experimenter on the psychology of thought processes.

SHAFFER, LAURANCE FREDERIC (1903-). Specialist in personality, clinical psychology, and mental hygiene, teaching at Carnegie Institute of Technology. His best-known book is *The Psychology of Adjustment*.

SHAW, CLIFFORD R. (1896-). Chicago sociologist, noted for his studies of community factors in juvenile delinquency. His books include *Delinquency Areas* (with associates), *The Jack-Roller*, and *Brothers in Crime*.

SHERIF, MUZAFER (1905-). Turkish-born social psychologist, best known for his book *The Psychology of Social Norms*. Teaching in Istanbul.

SHERMAN, MANDEL (1896-). Educational and clinical psychologist at the University of Chicago, noted for his studies of emotions and personality.

SHERRINGTON, SIR CHARLES SCOTT (1857-). Distinguished British neurologist and physiological psychologist, famed for his experiments on the physiological basis of emotions. His *Integrative Action of the Nervous System* is a classic in both neurology and psychology.

SHIRLEY, MARY MARGARET (1899-). American child psychologist, contributor of many studies on infant development. Teaches at Smith and Wellesley Colleges.

SIMON, THÉOPHILE (1873-). French psychologist, famous as the collaborator of Alfred Binet in devising the first intelligence tests.

SPEARMAN, CHARLES EDWARD (1863-). One of the most distinguished British psychologists. Known for his theory of a "general factor" in intelligence and for several contributions to statistical method. Teaches at the University of London. Author of *The Nature of Intelligence* and *The Abilities of Man*.

SPENCER, HERBERT (1820-1903). British philosopher, psychologist, and sociologist, who introduced evolutionary principles into psychology. He is regarded as one of the forerunners of social psychology. His books include *Principles of Psychology*, *Synthetic Philosophy*, and *Essays on Education*.

SPRANGER, EDOUARD (1882-). German psychologist, noted for his classification of six personality types, based on differences in fundamental interests and attitudes. Author of *Types of Men*.

STAGNER, ROSS (1909-). Dartmouth College psychologist, interested in personality and social psychology.

STARCH, DANIEL (1883-). Applied psychologist, head of a New York firm specializing in business and personnel psychology and in studies of consumer attitudes.

STEKEL, WILHELM (1868-1940). Viennese psychoanalyst, whose technique of therapy differs from that of the Freudians.

STENQUIST, JOHN L. (1885-). American educational psychologist, who constructed tests of mechanical ability. He is director of research for the Board of Education in Baltimore.

STERN, WILHELM (1871-1938). German psychologist, professor of psychology at the University of Hamburg. Famous as the founder of differential psychology and originator of the intelligence quotient. He wrote *Differential Psychology* and *General Psychology from the Personalistic Standpoint*.

STODDARD, GEORGE DINSMORE (1897-). Educational psychologist, formerly at the University of Iowa; now commissioner of education for the State of New York. Co-author of the Ferson-Stoddard law aptitude test. Sponsored and aided the Iowa studies of effects of environment upon intelligence. His *Meaning of Intelligence* is a recent book.

STRONG, EDWARD KELLOGG (1884-). Applied psychologist, noted for his studies of interests. Teaches at Stanford University. Author of *Vocational Interests of Men and Women*.

SYMONDS, PERCIVAL MALLON (1893-). Educational and clinical psychologist at Teachers College, Columbia University. Author of *Diagnosing Personality and Conduct* and *The Psychology of Parent-Child Relationships*.

TARDE, GABRIEL (1843-1904). French sociologist, considered one of the founders of social psychology because of his book, *The Laws of Imitation*.

TAYLOR, FREDERICK WINSLOW (1856-1915). Because of his pioneer studies of efficiency in industry, Taylor is known as the father of scientific management. He was a member of the American Academy of Mechanical Engineers. He wrote *Principles of Scientific Management*.

TERMAN, LEWIS MADISON (1877-). World-famous as the author of the Stanford-Binet intelligence test, first published in 1916 and revised in 1937. Other contributions include studies of genius and of gifted children, of factors in marital happiness, and of sex differences. He wrote: *The Measurement of Intelligence*, *Genetic Studies of Genius* (with associates), *Psychological Factors in Marital Happiness* (with associates), *Sex and Personality* (with C. C. Miles).

THEOPHRASTUS (B.C. 372-287). Famous Greek philosopher and naturalist, a pupil of Aristotle. Credited with originating the early form of personality study called "character writing."

THOMAS, WILLIAM ISAAC (1863-). One of the most noted American sociologists; a pioneer in studying the effects of cultural factors upon personality and social behavior. Teaches at Harvard University. Probably his most important books to psychologists are *The Polish Peasant in Europe and America* (with F. Znaniecki) and *The Child in America* (with D. S. Thomas).

THORNDIKE, EDWARD LEE (1874-). Often called the founder of animal psychology because of his original studies of learning in cats, dogs, chicks, fish, and monkeys. Later he became famous for his contributions to educational psychology, especially intelligence testing, transfer of training, adult learning, and motivation. Now professor emeritus of education, Teachers College, Columbia University. Among his most important books are *Animal Intelligence*, *Educational Psychology*, and *Adult Learning*.

THURSTONE, LOUIS LEON (1887-). One of the outstanding authorities on mental measurement. He pioneered in measuring attitudes and in de-

veloping new statistical techniques, especially factor analysis. Teaches at the University of Chicago.

TITCHENER, EDWARD BRADFORD (1867-1927). An Englishman, trained in Germany, who brought Wundtian structural psychology to America. At Cornell University, where he taught until his death, Titchener expounded his rigidly defined psychology in a series of manuals and texts. He also wrote *The Psychology of Feeling and Attention* and *The Psychology of the Thought Processes*.

TOLMAN, EDWARD CHACE (1886-). Experimental and comparative psychologist, noted for his researches on motivation and learning. Teaches at the University of California. His most important book is *Purposive Behavior in Animals and Men*.

TREDGOLD, ALFRED FRANK (1870-). Outstanding British authority on feeble-mindedness. His book *Mental Deficiency* has become a classic in the field.

VERNON, HORACE MIDDLETON (1870-). British industrial psychologist, author of important studies of factors affecting efficiency.

VERNON, PHILIP EWART (1905-). British investigator of personality, teaching at the University of Glasgow.

VITELES, MORRIS SIMON (1898-). Prominent industrial psychologist, teaching at the University of Pennsylvania. Author of *Industrial Psychology* and *The Science of Work*.

WALDEYER, WILHELM (1836-1921). German neurologist and anatomist, who formulated the theories of the neurone and of synaptic connections.

WALLAS, GRAHAM (1858-1932). Noted British political scientist and social psychologist. Author of *Human Nature in Politics*, *The Great Society*, *Our Social Heritage*, and *The Art of Thought*.

WARDEN, CARL JOHN (1890-). One of the foremost American comparative psychologists, famous for his study of the relative strength of animal drives and for his 3-volume *Comparative Psychology* (with T. N. Jenkins and L. H. Warner).

WATSON, GOODWIN BARBER (1899-). Educational and social psychologist, of Teachers College, Columbia University.

WATSON, JOHN BROADUS (1878-). Founder of Behaviorism. An early animal psychologist and student of learning, Watson also did original investigations of newborn babies. Formerly a teacher at the University of Chicago and Johns Hopkins, now engaged in advertising. He wrote *Behaviorism*, and other books expounding behaviorist views; also *Psychological Care of the Infant and Child*.

WEBER, ERNST HEINRICH (1795-1878). German anatomist and physiologist, famed as the founder of psychophysics. His chief discovery—that we perceive relative, not absolute, changes in the intensity of stimuli—has become known as “Weber’s Law.” Weber also did original research on the sense of touch.

WELLMAN, BETH LUCY (1895-). Leader of the Iowa School of psy-

chologists, who insist upon the importance of environmental determiners of intelligence.

WELLS, FREDERIC LYMAN (1884-). Experimental and clinical psychologist at Harvard University and Boston Psychopathic Hospital. Author of *Mental Tests in Clinical Practice*.

WERTHEIMER, MAX (1880-1943). Discoverer of the "phi phenomenon," or illusion of motion, and one of the founders of Gestalt psychology. Taught for many years at the Universities of Frankfurt and Berlin; and then at the New School for Social Research in New York.

WEYER, JOHANN (1515-1588). Dutch physician, whose naturalistic approach to mental disease set the stage for modern psychiatry.

WHITE, WILLIAM ALANSON (1870-1937). Prominent American neurologist and psychiatrist; superintendent for many years of St. Elizabeth's Hospital in Washington. Also a leader in the mental hygiene movement. Wrote *Diseases of the Nervous System* (with S. E. Jelliffe) and *Outlines of Psychiatry*.

WITMER, LIGHTNER (1867-). Clinical and educational psychologist at the University of Pennsylvania. Famed as the founder of the first psychological clinic.

WOODROW, HERBERT (1883-). Experimental psychologist and investigator of mental abilities. Teaches at the University of Illinois.

WOODWORTH, ROBERT SESSIONS (1870-). One of the most eminent American psychologists. Trained in the United States, and in England under G. S. Sherrington. Author of notable studies in learning, thinking, motivation, and personality. Teaches at Columbia University. Wrote *Dynamic Psychology*, *Contemporary Schools of Psychology*, and *Experimental Psychology*.

WUNDT, WILHELM (1832-1920). German physiologist and psychologist, called the father of experimental psychology because he established at Leipzig in 1879 the first psychological laboratory in the world. In addition to doing much valuable research himself, he taught many men who later became leaders in psychology; among them were Cattell, Titchener, Hall, Kraepelin, Münsterberg, Külpe, Witmer, and Judd. He also founded the first journal for experimental psychology. His best-known book is *Physiological Psychology*.

WYATT, STANLEY (1890-). British industrial psychologist, author of many studies of fatigue and its effects.

YERKES, ROBERT MEARNES (1876-). Noted as a comparative psychologist. Also served in a high official capacity during World War I, helping administer the Army testing program. Professor at Yale University. His best-known books are *The Dancing Mouse*, *Army Mental Tests* (with C. S. Yoakum), and *The Great Apes* (with A. W. Yerkes).

ZEIGARNIK, BLUMA WULFOMNA (1900-). Russian psychologist, author of an important study of memory in children.

ZNANIECKI, FLORIAN (1882-). Polish sociologist, best known for his *Polish Peasant in Europe and America* (with W. I. Thomas), a study of cultural influences upon personality and social adjustment.

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